THE EFFICACY OF SCRIPT CONTEXTS IN LANGUAGE COMPREHENSION INTERVENTION WITH TRAINABLE MENTALLY HANDICAPPED CHILDREN

BY

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To my Mother and Father,
two wonderful people, whose love
and support made this all possible.

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TABLE OF CONTENTS

	page
ACKNOWLEDGEMENTS	iii
LIST OF TABLES	vii
LIST OF FIGURES	viii
ABSTRACT	ix
INTRODUCTION	1
REVIEW OF THE LITERATURE	4
Comprehension Development	4
Comprehension versus Production	11
Language Comprehension Assessment	17
Sensorimotor Cognitive Development and Language comprehension	22
Symbolic Play and Language Comprehension	24
Function of Scripts in the Development of Language	26
Function of Scripts in Semantic and Syntactic Development	29
Utility of Script in Language Intervention	31
Summary	32
STATEMENT OF THE PURPOSE	34
Statement of the Purpose	34
Experimental Questions	36
METHODS	39
Rationale for Experimental Stimuli	39
Subjects	42
Experimental Stimuli	46
Procedures	48
Experimental Design	48
Baseline	49
Phase 2	50
Phase 3	52
Training Procedures	52
Script-Based Treatment	52

Nonscript-Based Treatment ... 56
Reliability ... 57
Dependent Variable ... 57
Independent Variable ... 57

RESULTS ... 59

Subject 1 ... 59
Baseline ... 59
Acquisition ... 60
Script Treatment ... 60
Nonscript Treatment ... 60
Generalization ... 62
Maintenance ... 63
Summary of Subject 1's Data ... 64
Subject 2 ... 65
Baseline ... 65
Acquisition ... 67
Script Treatment ... 67
Nonscript Treatment ... 69
Generalization ... 69
Maintenance ... 70
Summary of Subject 2's Data ... 71
Subject 3 ... 73
Baseline ... 73
Acquisition ... 73
Script Treatment ... 73
Nonscript Treatment ... 74
Generalization ... 76
Maintenance ... 77
Summary of Subject 3's Data ... 78
Subject 4 ... 78
Baseline ... 78
Acquisition ... 80
Script Treatment ... 80
Nonscript Treatment ... 82
Generalization ... 82
Maintenance ... 83
Summary of Subject 4's Data ... 84
Response Pattern Analysis for "Agent-Action-Object" Construction ... 86
Analysis of Comprehension Accuracy for Construction Types ... 87
Subject 1 ... 87
Subject 2 ... 87
Subject 3 ... 89
Subject 4 ... 89
Summary of Comprehension Accuracy ... 92
Analysis of Error Strategies ... 92
Subject 1 ... 94
Subject 2 ... 96
Subject 3 ... 96

Subject 4 97
Summary of Error Response Analysis 97
Summary of the Findings 99

DISCUSSION 104

Acquisition Effect of Script Treatment 106
Generalization of Script Treatment 109
Analysis System for Language Comprehension Treatment 111
Error Patterns for "Agent-Action-Object" Comprehension 113
Clinical Implications 114
Future Research 115

APPENDIX A SPONTANEOUS LANGUAGE SAMPLE AND SEMANTIC-GRAMMATICAL RULES 117

APPENDIX B VERBAL STIMULI 130

APPENDIX C EXAMPLE OF THE RESEARCHER'S ROUTINE PHRASES 137

APPENDIX D DESIGN FOR TWO TREATMENTS ACROSS SUBJECTS AND TIME PERIODS 140

APPENDIX E EXAMPLES OF SCORING SHEETS 141

APPENDIX F MATERIALS FOR EACH CONTEXT 146

APPENDIX G TREND LINES ACROSS SCRIPT AND NONSCRIPT CONDITIONS FOR TREATMENT AND GENERALIZATION DATA FOR EACH SUBJECT 151

APPENDIX H NUMBER OF CORRECT ACT-OUTS IN PAIRED-SCORING ANANLYSIS 156

REFERENCES 159

BIOGRAPHICAL SKETCH 170

LIST OF TABLES

Table		Page
1	Subject Characteristics	43
2	Summary of Experimental Phase 2: Subject, Treatment, and Target Behavior	51
3	Script Organization of Three Activities	54
4	Summary of Visual Analysis: Subject 1	66
5	Summary of Visual Analysis: Subject 2	72
6	Summary of Visual Analysis: Subject 3	79
7	Summary of Visual Analysis: Subject 4	85
8	Correct Responses across Treatment Sessions: Subject 1	88
9	Correct Responses across Treatment Sessions: Subject 2	90
10	Correct Responses across Treatment Sessions: Subject 3	91
11	Correct Responses across Treatment Sessions: Subject 4	93
12	Error Response Pattern of Agent-Action-Object	95
13	Summary of Error Analysis across Subjects	98

LIST OF FIGURES

Figure		page
1	Summary of Subject 1's Data for Training Items and Generalization Items in Two Treatments....	61
2	Summary of Subject 2's Data for Training Items and Generalization Items in Two Treatments.. . .	68
3	Summary of Subject 3's Data for Training Items and Generalization Items in Two Treatments.....	75
4	Summary of Subject 4's Data for Training Items and Generalization Items in Two Treatments....	81
5	Number of Correct Act-Outs to Two Semantic Relation Commands..... ...	102

Abstract of Dissertation Presented to the Graduate School of the University of Florida in Partial Fulfillment of the Requirements for the Degree of Doctor of Philosophy

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The present study was designed to investigate the acquisition, generalization, and maintenance effects of two treatments: script-based treatment representing a general event knowledge theory orientation and nonscript-based treatment reflecting a more traditional language comprehension paradigm. An alternating treatments design (ATD) in combination with a multiple baseline design across subjects was used to evaluate treatment effects in four trainable mentally handicapped preschoolers. Treatments were comprised of three script routines (popcorn-making, pudding-making, milkshake-making) and three nonscript activities. Two semantic constructions (agent-action-object, action-object-locative) were selected for training and counterbalanced across subjects and treatments. Daily probes and training

were administered to assess the effects of the treatments.

Script-based treatment was consistently more effective than the nonscript treatment in facilitating the subjects' comprehension of the targeted semantic constructions. For three subjects, the acquisition criterion was met first in the script treatment within 20 sessions. Although one subject's responses did not reach the criterion within 20 sessions for either of the treatment conditions, her correct responses increased more rapidly in the script treatment condition. Similarly, changes in generalization data in the script treatment condition were greater than those in the nonscript treatment condition for all four subjects. During the maintenance phase, in most cases, correct responses to the probes were maintained at training level or at a slightly lower level. Since the effects of the script-based treatment were clearly demonstrated across construction types (agent-action-object, action-object-locative) and routines (popcorn-making, pudding-making, milkshake-making), the findings of the present study provided support for using script-based contexts in language intervention with trainable mentally handicapped children. Further, analysis of the subjects' error responses patterns for the "agent-action-object" semantic construction revealed four predominant comprehension strategies. Clinical implications and suggestions for future research are discussed.

INTRODUCTION

Current language acquisition theories are founded on a theoretical framework that includes contributions from the social, cognitive, and linguistic domains of early childhood development. Today, most researchers in child language would agree that language acquisition has its basis in the child's early social and cognitive knowledge. In recent years Nelson and her colleagues have used adult script theory (Schank & Abelson, 1977) to explain children's development of language. Script researchers emphasize the importance of social context, especially routinized events (e.g., social games, book-reading) in children's language acquisition. They suggest that routinized event contexts provide shared event knowledge of the immediate situation and, in turn, provide children with the opportunity to learn relationships between utterances and their communicative functions. Further, these researchers contend that routinized contexts facilitate children's ability to predict adult's utterances and to develop associations between these utterances and the situations in which they occur. Thus, children's event representations seem to provide for conjoining cognitive and interactive contexts which facilitate the acquisition of language.

Script theory (Schank & Abelson, 1977) was originally designed for a computer model to simulate adult's inferential processes in understanding textual materials and ordered sequences of actions that are appropriate for a particular temporal, spatial context. Schank and Abelson (1977) used the term "script" to refer to a structure that describes appropriate sequences of events in a particular context. They stated that

> a script is made up of slots and requirements about what can fill those slots. The structure is an interconnected whole, and what is in one slot affects what can be in another. Scripts handle stylized everyday situations. They are not subject to much change, nor do they provide the apparatus for handling totally novel situations. Thus, a script is a predetermined, stereotyped sequence of actions that defines a well-known situation. (p. 41)

As noted above, the development of script formats or general event representations has recently been studied in preschoolers. Many researchers documented knowledge of scripts in children as young as 3-years-old and outlined developmental changes in the complexity of young children's scripts (Nelson, Fivush, Hudson, & Lucariello, 1983; Nelson & Gruendal, 1981; Nelson, 1978). Studies of script development in young children have employed one of two methodologies for examining children's script knowledge. One is an interview technique in which children were asked to verbally describe what happens during familiar situations (e.g., Franch, 1986; O'Connell & Gerard, 1985; Nelson & Gruendal, 1981, 1979; Nelson, 1978). The other method is to ask children to enact routines using toys.

Based on a theoretical framework that script events presumably reduce cognitive workloads and, in turn, increase the processing resources for children to learn language, many script researchers have provided evidence that scripted events allow children to produce more advanced language (e.g., French, 1986; Cerni & French, 1984; French & Brown, 1977). However, few studies have examined the role of scripts in children's comprehension of linguistic structures. Since scripted contexts seem to facilitate advanced language production, it may be effective to use the scripted context for language comprehension intervention. To investigate the efficacy of script context in language comprehension intervention, the present study compared the acquisition, generalization, and maintenance effects of script-based and nonscript-based treatments.

REVIEW OF THE LITERATURE

This review is limited to research on language comprehension and script development in young children. Language comprehension is discussed with respect to (a) how it develops; (b) its relationships with early cognitive development and with language production; and (c) how it can be measured. Script research is reviewed with respect to its relationship to language development. Thus, this chapter is organized under the following headings: comprehension development, comprehension versus production, language comprehension assessment, cognition and language comprehension and script and language development.

Comprehension Development

English-speaking children are typically 3 1/2 to 5 years old before they consistently use word order as a cue to meaning in active, semantically reversible sentences such as 'The boy washes the girl' and 'The girl washes the boy'. Several researchers have investigated how children understand reversible sentences before they use word order cues (Chapman & Kohn, 1978; Chapman & Miller, 1975; Strohner & Nelson, 1974; de Villiers & de Villiers, 1973; Owings, 1972, Carrow, 1968; Fraser, Bellugi, & Brown, 1963). Their findings suggest that

children use several response preferences on comprehension tasks. These preferences are termed "comprehension strategies" if the individual child shows these preferred response patterns consistently (for example, at least 80% of the time) in a sentence interpretation task (Chapman, 1978; Clark, 1975). Chapman (1974) stated that comprehension is the complete process of understanding a sentence whereas a comprehension strategy is "a short-cut, heuristic, or algorithm for arriving at sentence meaning without full marshaling of the information in the sentence and one's linguistic knowledge" (p. 310). Thus, children may use comprehension strategies as devices to facilitate understanding when they lack full linguistic competence. Children's comprehension strategies addressed in the literature are (a) child-as-agent strategy in which the child acts on one or both objects in the way mentioned (de Villiers & de Villiers, 1973; Sinclair & Bronckart, 1972); (b) probable event strategy in which the more probable event relation between nouns is preferred (Chapman, 1978; Strohner & Nelson, 1974, Bever, 1970), (c) animate agent strategy in which the animate noun in the sentence is acted out as the agent in preference to the inanimate noun (Chapman & Miller, 1975); (d) dynamic agent strategy in which the dynamic noun (e.g., car) is assigned to agent; and (e) word order strategy in which the first noun mentioned in a sentence is preferred as agent (Bever, 1970).

Chapman (1978) proposed that children at successive developmental levels use different comprehension strategies. At Sensorimotor Stage VI (18 to 24 months) or in the early preoperational period (2 to 4 years), children's comprehension is very contingent on their knowledge of what is usually done. Chapman argued that "simple sentence meaning during early pre-operations (2 to 4 years) is . . . derived from knowledge of the world rather than from knowledge of syntactic structure" (p. 318). During the periods of late preoperations (4 to 7 years) and concrete operations (7 to 11 years) children use additional strategies. A word order strategy may be used to interpret agency and object of action in simple active sentences. Similarly, children may use an order-of-mention strategy to comprehend sentences containing the conjunctions "before" and "after." A probable-relation-of-event strategy may be used to interpret conjunctions such as "because", "if", "although", and "but". Chapman concluded that most children are not able to use syntactic cues for understanding agent and object relationships in simple sentences until 4 or 5 years of age. The developmental progression of the strategies proposed by Chapman (1978) was supported by a more recent study by Harrison, Lombardino and Farrar (1985) which investigated 2- to 5-year-old children's comprehension of active and passive sentences in the script and nonscript contexts. The script contexts were organized around daily routines (e.g., taking a bath, going to bed)

while the nonscript contexts were developed with scrambled sentences and themes from the script contexts. Findings from their study revealed that the child-as-agent strategy and the probable-event strategy were used most frequently by the 2-year-olds and least frequently by the 4-year-olds. In addition, these comprehension strategies were used more frequently in the script contexts than in the nonscript contexts.

Bridges (1980) also reported age-related changes in the type of response patterns found. Preschool children between the ages of 2;6 and 5;0 were presented with reversible and passive sentences in four comprehension test settings. Results of her study suggested that many 2-year-olds used child-as-agent responses which she referred to as a "primitive" response pattern. Three-year-olds relied heavily on either word order or situational variables. Many 4-year-olds exhibited intermediate response patterns in which all but the most complex instructions were responded to appropriately. Bridges concluded that the most common response patterns before four years of age were those described by the situational considerations of proximity, mobility, preservation, and answering yes to every item. However, the situation-specific mobility strategy (e.g., child assigns a movable item as an agent) was not supported in Lempert's study (1978). Lempert showed that even 3-year-olds

almost always used word order strategies for reversible active sentences.

The reported ages at which word order becomes an important factor are not always consistent. Lempert and Kinsbourne (1980) reported that children as young as 2 1/2-year-olds assigned the agent role to the noun preceding the verb. On the other hand, Slobin and Bever (1982) argued that children below 2;6-3;0 do not process complete sentences and therefore do not rely on word order.

Chapman and Miller (1975) initially described an animate agent strategy used in children aged 1;8-2;8. Their results revealed that comprehension of the subset of sentences with animate subjects and inanimate objects (e.g., 'The dog is chasing the car') was near 100%, suggesting the presence of semantic strategies for subject-object comprehension. More recently, however, McClellan, Yewchuk, and Holdgrafer (1986) replicated Chapman and Miller's (1975) study and reported only partial support for the predictions made by Chapman and Miller. The proposed lexical semantic strategies for comprehension (i.e., animate agent strategy) were employed by the subjects aged 2;2-2;10 of the McClellan et al. study. McClellan et al. suggested that young children appeared to use a probable event strategy, rather than an animate agent strategy, in assigning agent and patient of the sentence. Subsequently, Chapman and Kohn (1978) studied the comprehension strategies of 25 2- to 3-year-olds. The

subjects were asked to act out 36 semantically reversible sentences containing one animate and one inanimate noun with toys. Two- and 2 1/2-year-olds showed consistent individual preferences for animate nouns as agents in some sentences but not others. Thus, the authors concluded that 2- to 3-year-olds use only a sentence-specific probable event strategy rather than a generally applied animate agent strategy.

Two comprehension strategies for passive sentences have been suggested in the literature, the dynamic agent strategy (Lempert, 1978) and inanimate agent passive strategy (Horgen, 1978). Lempert (1978) reported that young preschoolers aged 3- to 5 years consistently assigned agency to the dynamic inanimate (e.g., car, truck) when interpreting passive sentences. Lempert related her findings to Horgen's (1978) "instrumental (inanimate agent) passive" strategy and concluded that young children may assign agency on a probabilistic basis according to when an animate or a dynamic inanimate is a better agent in a given situation. Braine and Wells (1978) concur that 3-5 year old children may treat vehicles as instances of agency because they perceive these inanimates as being capable of self-propelled movement.

Further, Lempert and her colleagues (Lempert, 1985; Lempert & Kinsbourne, 1980, 1978) studied children's comprehension of the inverted cleft, as typified by 'It's the X that the Y verbs' (e.g., 'It's the car that the horse pushes'). Lempert and Kinsbourne (1980) studied 3-year-old

children's response patterns for the inverted cleft and described two response strategies. The first strategy was based on the use of a word order strategy whereby agency was assigned to the immediate preverbal noun (NV strategy). This strategy resulted in consistent correct interpretation of the inverted cleft sentences while it resulted in consistent incorrect interpretation of the passive sentences. The second strategy, in which agency was assigned to the first noun (N_1 strategy), resulted in incorrect interpretation of both passives and inverted clefts. To examine young children's animate agent approach, Lempert (1985) used the two types of the inverted clefts such as 'It's the horse that the car pushes' (AD) and 'It's the car that the horse pushes' (DA). Lempert hypothesized that (a) if the pattern AD>DA for passives also appears in the inverted cleft, dynamic agent strategy can be supported; (b) if the pattern AD>DA for passives does not appear in the inverted cleft sentences, inanimate agent passive strategy can be supported. Five age levels of children ranging in age from 3- to 5 years were assigned both to the passive and to the inverted cleft group. For the acting-out tasks four agent-patient combinations (animate-animate, animate-inanimate, inanimate-animate, inanimate-inanimate) were used. Children's response patterns showed that some children younger than 4-years of age assigned agency to the more dynamic referent (dynamic agent strategy) or to the first named inanimate (N_1 strategy) but not to the

inanimate referent (inanimate agent passive strategy). Therefore, this study provided evidence for a dynamic agent strategy rather than inanimate agent passive strategy in inverted cleft comprehension.

Overall, young children seem to use some strategies which aid in the comprehension of later acquired linguistic structures. In particular, children's real world event knowledge seems to serve as a framework for early language comprehension (Chapman, 1978).

Comprehension versus Production

Numerous anecdotal reports have suggested that children's comprehension precedes production in both semantic and syntactic areas. For example, a classic study of 3-year-old children's language (Fraser, Bellugi, & Brown, 1963) revealed that children's comprehension of grammatical contrasts (e.g., singular/plural, present/past) was superior to their production of those same contrasts. A later study by Goldin-Meadow, Seligman and Gelman (1976) demonstrated that children between 14- and 26 months understood many more nouns and verbs than they produced. This traditional view, however, had been challenged, at least partially, by recent researchers. For example, some semantic data documented that children used object labels and color terms before they could discriminate and recognize the represented concepts (Nelson & Bonvillian, 1978; Bartlett, 1977). Chapman (1981) also proposed that children produced some grammatical structures reflecting rules

which they did not understand. Keenay and Wolfe (1972) studied the acquisition of subject-verb agreement for number in a sample of 46 children between the ages of 3 years and 4 years, 11 months. Children's production data were based on spontaneous speech and elicited imitations of grammatical sentences. The comprehension tests were introduced on the tape and the children were asked to show their knowledge of subject-verb agreement by providing information on the number of subjects (e.g., "one bird" or "two birds") or by pointing to the picture. The results of the study indicated that children of this age can produce grammatically correct utterances with respect to this agreement while they cannot comprehend the singular or plural meaning of verb number inflection.

In addition, the hypothesis that comprehension of syntactic form precedes production was challenged by Chapman and Miller (1975). They studied children's comprehension and production of subject-object order in semantically revereible sentences which allowed for both animate and inanimate subjects and objects. Four types of sentences used in this study were (a) animate-animate (e.g., 'The boy is hitting the girl'); (b) animate-inanimate (e.g., 'The dog is chasing the car'); (c) inanimate-animate (e.g., 'The boat is hitting the girl'); and (d) inanimate-inanimate (e.g., 'The truck is pulling the boat'). Three groups of fifteen children participated and the average mean length of utterance (MLU)

for each group was 1.8, 2.4 and 2.9, respectively. Children were asked to do what the experimenter said in the comprehension task and to describe what the experimenter did in the production task. All three groups of children performed correct word order for subject and object significantly better in the production task than in the comprehension task, providing evidence that production precedes comprehension in grammatical acquisition for subject-object structures. The authors also compared the pattern of responses between two tasks. Among four types of sentences children performed best in the sentence possessing an animate subject and an inanimate object, suggesting the presence of semantic strategies (i.e., animate agent strategy) for subject-object comprehension. This pattern of response, however, was not demonstrated in the production task. Thus, the authors concluded that: (a) grammatical production precedes comprehension; and that (b) the child's production strategies bear no obvious relation to his comprehension strategies in early stages of language acquisition. More recently, McClellan et al. (1986) replicated Chapman and Miller's study (1975) with a slight methodological modification. McClellan et al eliminated three verbs used in Chapman and Miller study since these verbs required more physical action than the rest of the verbs. Further, these researchers presented only two toys to the child, instead of six toys. Several findings were consistent across the two

studies (a) significantly greater numbers of errors were scored on the comprehension task than on the production task; (b) response patterns as a function of sentence types were dissimilar between the comprehension and production tasks; and (c) no significant differences in error scores were found among sentence types for the production task. On the other hand, the preferred response patterns in the comprehension task (i.e., comprehension strategy) were not consistant across the two studies. Errors on animate-inanimate sentences were significantly greater than on the other types of sentences (i.e., animate-animate, inanimate-animate, inanimate-inanimate sentences) in the McClellan et al study, while errors on this type of sentence were significantly less than other types of sentences in the Chapman and Miller study.

With regard to methodological approaches to the comprehension-production issue, several studies challenged the notion that production precedes comprehension (Cocking & McNeil, 1981; Fernald, 1972). Fernald (1972) noted that there are usually more nonlinguistic cues available for comprehension than for production. Nonlinguistic cues provide relatively little assistance for producing words and sentences but they may be very beneficial for guessing the meaning of sentences and words a child does not understand. Fernald (1972) replicated a classic study (Fraser et al., 1963) which showed that 3-year-old children's comprehension of grammatical contrasts was better than their production of those same

contrasts. Fernald pointed out that the scoring system of the Fraser et al. study created a bias against the production task because Fernald did not give credit for "novel responses" (e.g., child says, 'The grass is green' when the correct response is 'The deer is jumping'). Such responses were scored as incorrect in the Fraser et al. study. Fernald reported that removal of the scoring artifact revealed no significant differences between scores on the comprehension and production tasks. More recently, Cocking and McNeil (1981) noted that the effects of task demands on comprehension and production are not same. In their study, six different tasks were administered, one to each group of children. The tasks varied across two dimensions: stimuli media (pictures, objects, object-choice) and type of response (comprehension, production). The differences between comprehension and production tasks were tested for significance across each of 36 linguistic structures (e.g., actives, prepositions, comparatives, conjunctions). The results of this study revealed that (a) 4- to 5-year-olds performed significantly better on the comprehension tasks than on the production tasks across different kinds of stimulus materials and (b) comprehension and production could be affected differentially by the two stimuli media (i.e., picture, object-choice). In the production mode, children performed better using objects than using either pictures or object-choice materials. In the comprehension mode, however, the only significant

difference in children's performances across the three conditions was between pictures versus object choice, the former being the easiest. From their results, Cooking and McHale proposed that

> When a task demand of comprehension or production is combined with the additional demand to make inferences based on stimuli, the more difficult of the two language functions (i.e., production) is seriously affected while the developmentally easier of the two (i.e., comprehension) is less noticeably affected, at least for children of 4- and 5 years of age. (p. 11)

In summary, the issue with regard to the relationship between children's comprehension and production of linguistic form remains controversial. Sometimes language comprehension appears to be in advance of language production and sometimes the reverse relationship is reported. These discrepant findings are the result of a number of factors including the domain of language studied (lexical, morphological, syntactic), the tasks used to assess language comprehension (object manipulation, picture pointing, signal detection) and the age of the subjects (Golinkoff, Hirsh-Pasek, Cauley, & Gordon, 1987). However, findings from research comparing comprehension and production performance suggest that although the child has to have heard a word or linguistic structure before he can use it, the child may need not necessarily understand the word or linguistic structure before producing it. Thus, understanding may come through use (McCormick, 1984).

Language Comprehension Assessment

Several procedures have been used to assess young children's language comprehension: acting-out tasks, pointing-to-picture tasks, diary studies, and signal detection. A brief description of these procedures follows.

Many studies have used comprehension tasks that require children to use objects to 'act out' events. First, the acting-out task is used in either a construction task or a completion task paradigm (Bridges, 1980). The construction task, in which the child is required to manipulate toys to demonstrate the event described by a sentence, is probably the most frequently reported in the literature. This task can be conveyed by enactment (e.g., 'Make the the boy hit the girl') or by action directives (e.g., 'Bring me the doll'). For example, Goldin-Meadow et al. (1976) used the enactment task to assess young children's lexical comprehension. To assess nouns children were asked 'Where's (point to, show me, or bring me) the X (noun) ' To assess verbs children were asked to 'Make the doll Y (verb)' or to 'Y' himself The completion task, in which the child is required to finish the partially completed array, is another type of the action-out task. In the completion task, the child is not left alone to construct the entire configuration of toys himself; he is helped by the experimenter (Huttenlocher & Strauss, 1968; Huttenlocher & Weiner, 1971)

Secondly, the task of pointing to one of two or more pictures has been used frequently in traditional assessments of comprehension. However, data from recent research has revealed many measurement problems with this methodology. Golinkoff et al. (1987) argued that "pictorial displays may fail to provide subjects with sufficient incentive to perform, and may fail to make sought-after distinction salient" (p. 25). Pictorial representation of specific linguistic forms such as active intransitive verbs involving movement (e.g., jump), spatial or temporal relational terms (e.g., on top of, after), and transitive verbs involving more than one individual acting (e.g., tickle) are often very ambiguous. Consequently, the picture pointing tasks offer only a weak methodology for testing verb comprehension and word order comprehension (Golinkoff et al., 1987). Several studies revealed that the use of three dimensional objects may be a more sensitive method of assessing children's language comprehension than the use of pictures. In O'Connell and Gerard's (1985) study, 20-, 24-, 28-, and 36-month olds were presented with three types of event sequences: (a) events in a canonical order; (b) same events in a reversed order, and (c) scrambled sequences consisting of unrelated components of the canonical sequences. Following the experimenter's modeling of each sequence, the child was given the toys and asked to reproduce the sequence. Their results indicated that the 28-month-olds were able to reproduce the events in a

reversed order and the 36-month-olds were able to reproduce the events in a scrambled order. In a picture-sequencing task, however, even 4- and 5-year-olds exhibited difficulty reproducing sequences in a reversed order (Fivush & Mandler, 1984). Cocking and McHale (1981) also reported young children's better comprehension and production of the linguistic structures in the object tasks than in the picture tasks. Further, several studies (Friedman & Stevenson, 1975; Cocking & McHale, 1981) indicate that young children do not understand pictorial conventions such as curved lines around joints to indicate that movement is taking place (cited in Golinkoff et al., 1987).

Thirdly, diary studies have been used to address assessment of language comprehension (cited in Golinkoff et al., 1987). However, Golinkoff et al. (1987) proposed that diaries may tend to overestimate a child's comprehension abilities. They suggested that children's comprehension abilities reported in the diary studies tend to be "biased towards nouns, biased against an understanding of action terms, and biased against the relationships embedded in grammatical constructions." (p. 26)

Finally, some studies have used signal detection task paradigms to examine children's comprehension. This methodology requires minimal motor movement and relies on the differential visual fixation of two simultaneously presented film events accompanied by a single linguistic stimuli.

Spelke (1979, 1976) used this task paradigm to assess infants' intermodal perception (cited in Golinkoff et al., 1987). Golinkoff (1975) and McHale (1973) attempted to operationalize the concepts of agent and recipient for minimally verbal children by using filmed events. More recently, Golinkoff et al. (1987) used this paradigm to assess language comprehension of children between the ages of 1;4 and 2.4. For three linguistic structures (nouns, verbs, word-order), children more often looked at the screen which matched the linguistic stimulus than the nonmatched screen. Thus, the authors proposed that this method may provide insight into the children's emerging linguistic capabilities. However, this signal detection paradigm may pose some methodological problems. For example, children may choose not to favour the matched over the non-matched screen. High chance of guessing (50%) is another potential problem in this paradigm.

Huttenlocher (1974) discussed several considerations with respect to assessment of young children's language comprehension. In evaluating sentence comprehension, one must determine whether the child understands each of the individual lexical items and whether the child understands the relational meanings between the words. In addition, Huttenlocher suggested that even if the examiner makes available various response options, appropriate responses to sentences does not necessarily imply comprehension. She noted that children's behavioral preferences could be confounded with their

comprehension abilities. For example, the child may put a block on top of the cup instead under the cup in response to the sentence 'The block goes on top of the cup', mainly due to the motor difficulty of the alternatives (e.g., it may be more difficult to balance the cup on top) or to perceptual factors related to the task (e.g., the block may look better). Therefore, issues concerning children's possible perceptual and behavioral preferences seem to pose challenging problems in the design and interpretation of experiments on comprehension. In Donaldson and Wale's study (1970) children also showed their perceptual and behavioral preferences. Some children always picked up a similar or a larger object regardless the verbal stimuli (e.g., "same" or "different", "more" or "less"). Chapman and Miller (1975) also reported that their subjects aged 1;8 to 2;8 tended to use the smaller of two toys as the agent in an acting-out comprehension task. However, this object preference based on relative object size was not found in a later study (Chapman & Kohn, 1978).

To reduce the comprehension assessment problems, Miller and Paul (in press) suggested that the child's comprehension for words and sentences be assessed by eliminating nonlinguistic and extra-sentential cues. Further, they proposed that the child's use of comprehension strategies can be assessed by presenting sentences beyond the child's linguistic level and looking for the types of processing heuristics employed. Chapman and Miller suggested including

both the original sentence (e.g., 'The girl is pulling the boat') and its reversed form (i.e., 'The boat is pulling the girl') when the child's comprehension of word order is the target of the assessment (cited in Miller, in press). To assess the child's comprehension of locatives, Hodun (1975) proposed to include improbable locations (e.g., 'The candy is in the mailbox') (cited in Miller, in press).

Sensorimotor Cognition and Language Comprehension

Three perspectives on the relationship between cognition and language have been proposed: strong, weak, and correlational (Bates, Benigni, Bretherton, Camaioni, & Volterra, 1977; Cromer, 1974). The strong version of the cognition hypothesis assumes that a specific cognitive attainment is sufficient for the acquisition of the corresponding language milestones. The basic assumption of this version is that language acquisition depends on mastery of sensorimotor concepts. The weak version of the cognition hypothesis assumes that cognitive development is necessary, but not sufficient in itself to account for language development. The correlational version of the cognition hypotheses assumes close temporal association of the two domains, but not necessarily precedence of the cognitive milestones. Among the cognitive achievements which language researchers have hypothesized to be related to aspects of language development in the second year of life are a general capacity for representational thought (Bowerman, 1973): the

specific attainment of object permanence (Corrigan, 1978; Sinclair-de-Zwart, 1973; Bloom, 1973); the recognition that other people can serve as agents of action (Bates, 1976); and the ability to use novel actions in the service of familiar goals (Bates et al., 1977). Evidence for a relationship between language production and stages of sensorimotor cognitive development has been identified for the onset of words (Corrigan, 1978; Ingram, 1978), the semantic aspects of word use (Dihoff & Chapman, 1977), the use of relational words (Tomasello & Farrar, 1986; Gopnik & Meltzoff, 1984) and the onset of two-word combinations (Corrigan, 1978; Folger & Leonard, 1978). Although most of these predictions have concerned the relationship between cognitive characteristics and language production, several researchers reported correlations between sensorimotor stages of cognitive development and levels of comprehension For example, Miller, Chapman, Branston, and Reichle (1980) performed a cross-sectional study of language comprehension in relation to cognitive functioning in forty-eight 10- to 21-month olds. They compared children's performance on six sensorimotor subscales with their performance on eight language comprehension items Their results revealed significant correlations between comprehension and five out of six sensorimotor subscales. With regard to cognitive prerequisites to comprehension development, however, they suggested that overall sensorimotor stage VI functioning was

clearly not a necessary prerequisite to the development of the comprehension of one- and two-word semantic roles assessed in their study. In addition, comprehention items were ordered from easy to hard as follows: (a) understanding single words for present people or objects; (b) understanding single words for actions; (c) understanding single words for absent people or objects; (d) understanding two words for the semantic relations (e.g., possessor-possession, action-object, and agent-action); (e) understanding three words for agent-action-object. Based on their results these authors suggested consideration of the following parameters when interpreting a child's apparent comprehension: (a) the presence or absence of the referents; (b) the number of words the child actually had to attend to in order to comply; (c) the particular semantic relation expressed; (d) the probability of the action in the absence of the request; (e) the availibility of nonverbal cues; and (f) the presence of supporting contexts.

Symbolic Play and Language Comprehension

The relationship between language and play was first explored in the 1960's when Piaget (1962) and Werner and Kaplan (1963) suggested that both language and play develop as by-products of the acquisition and development of semiotic abilities (i.e., abilities to make something such as a word or an object represent something else which is not present). While no direct cause and effect relationship between symbolic play and language has been clearly established, research has

indicated that both systems appear to be dependent on the same underlying general structure (Ungerer & Sigman, 1980; Bates, Benigni, Bretherton, Camaioni, & Volterra, 1979, 1977; Bates, Camaioni, & Volterra, 1975). Several studies (e.g., McCune-Nicolich, 1981; Bates et al., 1979, 1977, 1975) reported the co-occurrence of first words and initial pretend behavior. McCune-Nicolich (1981) reported that within the presymbolic level of play when meanings are fused with actions, there appears to be an analogous relationship existing in language. For example, concurrent with the onset of true pretend behavior comes the emergence of referential words. She also suggested that as behaviors become increasingly decentered (i.e., directed away from self) there appear to be two qualitative changes in children's single-word utterances. First, children begin to use words which refer more specifically to the dynamic aspect of actions and/or events (e.g., "more", "allgone"). Second, children exhibit more differentiated vocabularies. Several researchers (e.g., Bates et al., 1979; Nicolich, 1977) showed that both play and language proceed in a parallel fashion from single units to combinations. Nicolich (1977) noted two levels of early word combinations which corresponded to her two highest levels of play (i.e., Multischema Combinations, Planned Symbolic Combinations). Bates et al. (1977), in their longitudinal study of cognition and communication in 9- to 13-month-olds,

found that combinatorial play was a good predictor of language comprehension in the 9 to 13 month of age range.

Watson and Fischer (1977) investigated the developmental sequence of agent use in pretend play and correlated this finding with the developmental progression of object permanence. Their sample consisted of 36 children distributed into 14-, 19-, and 24-month-old groups. From their findings, they suggested the following developmental agent play sequence: (a) self as agent, (b) passive other agent, (c) use of a substitute object as a passive agent, and (d) the use of an object as an active agent (agent play).

Function of Scripts in the Development of Language

Current language acquisition theory emphasizes the primacy of developing communicative competence (e.g., communicative intents, communicative acts) rather than isolated skills. It attempts to explain children's acquisition in interaction with the environment (i.e., language use in social contexts). Nelson applied Schank and Abelson's adult script theory (1977) to explain children's language development in event contexts. Script theory was originally designed for a computer model to simulate inferential processes in understanding textual materials and ordered sequences of actions that are appropriate for particular temporal and spatial contexts and organized around a goal

Script researchers suggest that the language children use in describing event knowledge appears to be more complex and more advanced than the language they use in other situations. That is, children tend to use more complex and advanced language in scripted contexts than in non-scripted contexts. Bruner and his colleagues (Bruner, 1978; Ninio & Bruner, 1978; Ratner & Bruner, 1978) argued that scripts provide the child with an opportunity to display his most sophisticated linguistic behaviors. They emphasized the importance of social context, especially routinized events (e.g., social games, book-reading) in the acquisition of language. For example, they suggested that book-reading can be an effective social context in language acquisition since this routine provides simplified and repetitive linguistic stimuli, immediate feedback, and turn-taking. Ninio and Bruner's study (1978) reported that participating in a ritualized dialogue, rather than imitation, was effective in increasing vocabulary. From a longitudinal study over a period of 11 months from their subject's age of 1;10, Snow and Goldfield (1983) recorded conversations between the child and his mother around picture-book reading. By examining recurrent discussions of the same picture, they found that the child used utterances in the book-reading context which could be directly traced to what his mother had said in previous occurrences of that context. Therefore, they viewed not only the routinisation of the situations but the predictability of

the utterances used by mothers in these situations are important factors in language learning.

Conti-Ramsden and Friel-Patti (1985) also studied children's communicative behaviors in different contexts. They studied three situations relative to their degree of scriptedness: (a) mother-child play with familiar toys (most scripted); (b) mother-child play with no toys; and (c) mother-child play with unfamiliar toys (least scripted). They reported that children exhibited more complex linguistic behaviors (e.g., higher MLU), more sophisticated discourse behaviors (e.g., frequent initiating), and more sophisticated dyadic behaviors (e.g., frequent turn-taking) in the more scripted contexts. Snow, Perman and Nathan (1986) also reported more complex and sophisticated linguistic behaviors (e.g., higher MLU, grammatical markers) in more familiar and routinized situations. In a recent study (Harrison et al., 1989), the positive effect of script organization on children's language comprehension was also demonstrated. From their study with sixty children between the ages of 2 and 5 years, the authors found that the effects of script organization on comprehension differ across age levels. For example, their 2-year-olds relied more strictly on script knowledge when they lacked syntactic comprehension than the older groups.

Nelson and her colleagues (Nelson, 1986; Lucariello, Kyratzis, & Nelson, 1983; Lucariello & Nelson, 1982; Nelson

& Gruendel, 1981, 1979) suggested that event context seems to enrich mother-child use of language since event knowledge provides: (a) shared event knowledge of the immediate situation; (b) maternal interpretation of the child's utterance; and (c) maximal processing capacity for language learning. They emphasized the importance of shared cognitive context in children's language acquisition. At the early stage of language acquisition, children often use words with no communicative intentions. Since the event context allows a shared frame of reference between the mother and child, the mother can easily assign pragmatic functions to the children's words. This shared event knowledge provides the child with the opportunity to learn the relationship between his utterance and function of language. In Nelson and her colleagues' view, another important factor of facilitating children's language acquisition in event contexts is that specific contexts facilitate the predictability of utterances. In familiar, routinized contexts, the child can predict the adult's utterances and develop associations between the utterances and the situation so that he can learn situation-specific utterances. Nelson argued that event representations provide for conjoining cognitive context and interactive context, which facilitate language acquisition

Function of Scripts in Semantic and Syntactic Development

In a summary review of script research, Franch (1986) postulated that preschoolers seem to understand that certain

actions come before other actions and they use relational terms (e.g., "before" "after") at least in familiar contexts. Further, French showed that relational terms for option (e.g., or, if, sometimes, but), cause (e.g., because), and temporal sequence (e.g., before, after) have been used by children in their verbal descriptions of scripts at an earlier age than suggested by previous research (e.g., Emerson, 1980, 1979; Clark, 1971). For example, Clark (1971) reported that children did not show their acquisition of the temporal constructions "before" and "after" until 5 years of age. In her study, forty children aged 3 to 5 years were asked to act out instructions containing "before" and "after". Children exhibited four stages in the acquisition of before-after: (a) children understood neither word; (b) children understood "before" but not "after"; (c) children interpreted "after" as if meant "before"; and (d) children understood both words correctly. On the other hand, Carni and French (1984) assessed 3- and 4-year-old children's comprehension of "before" and "after" with a consideration of children's real world event knowledge. The 32 children included in their study were required to answer questions that referred to pictured event sequences having invariant and arbitrary real world temporal orders. While 4-year-olds performed well with both types of sequences, 3-year-olds performed well with invariant sequences only. Their results indicated that 3-year-old children's comprehension of "before" and "after" may

processed in a context-sensitive manner. They argued that it is not lexical knowledge that is of central importance within this age range, rather it is the ability to coordinate lexical knowledge with the cognitive demands of responding to arbitrary sequences.

Utility of Script in Language Intervention

Many script researchers have provided evidence that scripted events allow children to comprehend or produce more advanced language. However, few studies have examined whether the scripted context can actually facilitate communicative and linguistic skills in children who are having difficulty acquiring those skills. Constable (1986) performed language production intervention with language-impaired children using scripted activities. Although she did not report her experimental data, she suggested that script research seems to contribute to language intervention in several ways. First, script theory provides guidelines for the content of the nonlinguistic features of intervention events. Secondly, scripted events presumably reduce cognitive workloads and, in turn, increase the processing resources or capacity that children can apply to the language learning task. Thirdly, scripted events facilitate the expression of more advanced linguistic skills. She also suggested several language intervention strategies which can be used in scripted contexts. These are turn-taking formats, play-with-language routines, and intentional violations of various aspects of

routines events. The turn-taking format would facilitate the representation of speech act which can be processed as a slot in a script. This format can also provide redundancy of linguistic stimuli and repeated chances to practice situation-specific utterances. Play-with-language strategy may make language therapy as a playful routine with verbalization. In addition, intentional violation of various aspects of routine events presumably facilitates children's communicative acts.

Summary

Research with respect to children's language comprehension and script were reviewed. When they lack of linguistic knowledge, young children tend to use comprehension strategies such as child as the agent strategy, probable event strategy, dynamic agent strategy, animate agent strategy, or word order strategy. These strategies, however, may lead the child to comprehend incorrectly when comprehension of the more advanced linguistic structures is required. For example, the child who relies primarily on the word order strategy for an active sentence may overgeneralize this strategy to a passive sentence, resulting in an incorrect response. Therefore, these comprehension strategies should be considered when assessing the child's true language comprehension abilities. Stimuli for investigating syntactic comprehension should involve inanimate as well as animate nouns, reversed as well as original sentences, and improbable as well as probable sentences.

The issue as to whether comprehension precedes production or production precedes comprehension remains controversial. However, it seems that the relationship between comprehension and production changes as function of child age and linguistic domain. In other words, the relationship between comprehension and production should be discussed in terms of the child's age and specific linguistic structures such as morphology and syntax.

Although the specific cognitive abilities may not necessarily be prerequisite to his language comprehension, these two domains seem to be correlated. In addition, developmental level of symbolic play seems to be related to language comprehension performance although causal relationships between these two domains have not been unequivocably demonstrated.

Script literature suggests that scripts can provide social and cognitive contexts for language comprehension as well as production. Since scripted contexts seem to facilitate advanced language performance, scripts may serve an ideal context for language intervention. To date, however, no study has been conducted to examine the differential effects of scripted and nonscripted contexts on language comprehension intervention.

STATEMENT OF THE PURPOSE

Statement of the Purpose

Research on early child language suggests that the comprehension and the production of earlier words or linguistic structure takes place in situations that are rich in interpersonal communication. Messer (1980) emphasizes the "nonverbal" aspects of communication that might assist the child in comprehending the link between concept and referent object. He suggests that researchers consider features of the extralinguistic environment and affective events in early language development. Garvey (1983) contends that contextual cues are important in the comprehension of reference terms. In addition to contextual cues, Garvey underscores the importance of the role of social interaction and social knowledge in language learning. For example, as a certain game or activity becomes familiar or routinized, the child comes to know that in that game or activity he will have a chance to manipulate the objects and that some events will be accompanied by situation-specific language. This notion of routinized events is closely related to the notion of "scripts" (Snyder-McLean, Solomonson, McLean, & Sack, 1984) which allows the child to organize his routinized event

knowledge into a temporal, spatial cognitive structure or scheme.

In recent years Nelson and her colleagues have developed a general event knowledge theory founded on adult script theory (Schank & Abelson, 1977) to explain children's development of language. They suggested that general event knowledge or scripts provide shared event knowledge of the immediate situation between mother and child and, in turn, allow the child to predict the adult's utterances and develop associations between the utterances and the situations in which they occur. Nelson (1986) argued that event representations provide conjoining cognitive context and interactive contexts which facilitate language acquisition. Therefore, the structure of routines or scripts appear to provide a "scaffold" (Bruner, 1975) allowing the child to respond appropriately within a specific context when the child's limited response repertoire might not allow him to respond appropriately in other contexts.

Theoretically, script-knowledge or general event knowledge allows for contextual expectations or predictions such as actor(s), action(s) and object(s). As the script context becomes familiar to the child, he is presumably able to understand or produce those utterances or linguistic structures that are associated with that context. Script researchers (Conti-Ramsden & Friel-Patti, 1983; Nelson, 1986, 1978; Snow & Goldfield, 1983; Ninio & Bruner, 1978) have

provided evidence that children perform better on comprehension and production tasks in script contexts than in other contexts. Therefore, script contexts presumably facilitate the child's development of language comprehension and production.

Constable (1986) suggested that script-based intervention has facilitating effects on language production in language impaired children. While she provided a methodology for script treatment, she has not shown empirical data to support the efficacy of script-based treatment. Therefore, a systematic and controlled experiment needs to be conducted to demonstrate if, indeed, script contexts function to facilitate language comprehension better than traditional, nonscript-based contexts. In response to the need to investigate the potential effects of script organization on language comprehension intervention, this study is designed to compare the acquisition, generalization, and maintenance effects of script and nonscript treatments.

Experimental Questions

The present study was designed to answer the following experimental questions:

1. Will script- or nonscript-based intervention be more effective in facilitating the language comprehension of the "agent-action-object" and "action-object-locative" semantic constructions in trainable mentally handicapped preschoolers?

2. Will script- or nonscript-based intervention be more effective in facilitating generalization of the language comprehension of the "agent-action-object" and "action-object-locative" semantic constructions in trainable mentally handicapped preschoolers?
3. Will script- or nonscript-based intervention be more effective in facilitating maintenance of language comprehension for the "agent-action-object" and "action-object-locative" semantic constructions in trainable mentally handicapped preschoolers?
4. Will trainable mentally handicapped preschoolers comprehend particular sentence pattern types more accurately than other sentence pattern types for the "agent-action-object" semantic construction?
5. What comprehension strategies do trainable mentally handicapped preschoolers use in response to "agent-action-object" semantic constructions?

The following hypotheses were generated:

1. Compared to the nonscript-based intervention, script-based intervention will show stronger treatment effects on the "agent-action-object" and "action-object-locative" semantic constructions.
2. Compared to the nonscript-based intervention, script-based intervention will show stronger generalization effects for the "agent-action-object" and "action-object-locative" semantic constructions.

3. Compared to the nonscript-based intervention, script-based intervention will show stronger maintenance effects on the "agent-action-object" and "action-object-locative" semantic constructions.
4. Animate-agent sentences will be comprehended more accurately than inanimate-agent sentences.
5. Comprehension strategies (e.g., child-as-agent strategy, probable-event strategy) reported in normal child comprehension studies will also be demonstrated by the trainable mentally preschoolers.

METHODS

The purpose of this study was to compare the effects of two treatments on the language comprehension performance of mentally retarded children. Of primary interest was the investigation of the acquisition and generalization of delayed children's comprehension of three-word semantic constructions. The two three-word semantic constructions chosen for analysis were: (a) agent-action-object and (b) action-object-locative. These semantic constructions were trained using two types of treatments, script-based and nonscript-based treatments. In addition, stimulus generalization to untrained exemplars and maintenance of trained responses were measured. Further, each subject's responses to the "agent-action-object" semantic constructions were analyzed throughout the sessions to examine whether the trainable mentally handicapped preschoolers serving as subjects in this study also use the comprehension strategies (e.g., child-as-agent strategy, probable-event strategy) reported in child language comprehension studies (e.g., McClellan et al., 1986; Chapman & Miller, 1975).

Rationale for Experimental Stimuli

All target behaviors were developmentally closely equivalent three-word semantic constructions. McDonald (1978)

examined twenty-eight preschoolers' acquisition of three-word constructions from the spontaneous speech samples. McDonald referred to "semantic notions" only when words exhibited semantic functions. McDonald's study revealed that five three-word semantic constructions characterized over 75% of his subjects' spontaneous utterances. These primary three-word semantic constructions were: (a) agent-action-object (e.g., 'He ride horse'); (b) experiencer-state-source (e.g., 'I want milk'); (c) introducer-modifier-object (e.g., 'It's my ball'), (d) agent-action-location (e.g., 'Truck go there'); and (e) action-modifier-object (e.g., 'Rock baby doll'). In the present comprehension study, two of these three-word constructions, agent-action-object (e.g., 'The baby feeds the dog') and action-object-locative (e.g., 'Put the dog under the chair') were chosen as target constructions for treatment.

Using a picture identification task, Owings (1972) reported that 37% of the 3-year-olds studied comprehended "on/under" prepositions while over 90% of the 4-year-olds comprehended these prepositions (cited in Miller & Yoder, 1973). Using a similar picture identification task, Carrow (1968, 1973) revealed that the 3-year-olds met the 60% criterion level for the "on/under" prepositions. Bangs (1975) also suggested that "on" and "under" are acquired between the ages of 2;6-3;0 and "in front of" and "next to" prepositions are acquired between the ages of 3;6-4;0. In a placement task (Hodun & Clark, cited in Miller, in press), the prepositions

"in", "on", and "under" were understood by 50%-85% of children at 2 1/2 years of age while the preposition "in front of" was understood by most of children at 3 1/2 years of age. Further, Hodun (1975, cited in Miller, in press) reported that a third of children studied from 2 to 4 years understood "in front of". Thus, these studies indicate that the children between the ages of 2 and 4 years acquire the prepositions "on", "under", "in front of", and "next to."

Owings (1972), using a picture identification task, reported only 3% of 3-year-olds correctly responded to "agent-action-object" semantic construction while 47% of 4-year-olds correctly responded to this semantic construction. Carrow (1968, 1973) reported that 3-year-olds correctly responded to "agent-action-object" semantic construction at 60% criterion level. Further, Miller (in press) suggested that the "agent-action-object" semantic construction was acquired from 2 1/2 to 5 years of age.

Several studies (e.g., Harrison et al., 1989; Chapman, 1978, Miller, in press) suggested that many 2- to 4-year-old children tend to use the probable event strategy or the animate agent strategy to comprehend active, transitive sentences when they lack full linguistic competence. In "agent-action-object" items, these comprehension strategies presumably lead children to act out probable sentences (e.g., 'The baby is kissing the candy') correctly. Conversely, these comprehension strategies may lead the child to reverse agents

and objects in improbable sentences where an inanimate-object acts on an animate-object (e.g., 'The candy is kissing the baby'). To insure a reliable assessment of young children's comprehension skills Chapman and Miller (1975) suggested to use the both original sentences (e.g., 'The girl is hitting the boat') and their reversed sentences (e.g., 'The boat is hitting the girl') and to vary animacy of the agent and object of the sentence (e.g., animate agent vs. inanimate agent; animate object vs. inanimate object).

Subjects

Four female trainable mentally handicapped children, three blacks and one Caucasian ranging in mental age from 23 to 30 months, participated in the study. Each subject's mental age (MA) was determined by her recent performance on standard tests of intellectual functioning conducted at her school. None of the subjects were identified as having serious affective, motor, uncorrected visual or hearing impairments. All subjects were enrolled in a mentally handicapped preschool and receiving group therapy by a school speech clinician for expressive language. Table 1 summarizes subject characteristics.

Prior to the study, each subject's level of nonverbal symbolism was assessed in symbolic play. Three sets of toys representing cooking, telephoning and doctoring themes were presented separately to each subject. The subject was allowed to play with the toys during the initial 10 minutes. During

Table 1 Subject Characteristics

Subject	C A (mos.)	Sex	Race	M A (mos.)	AC Age in PLS (mos.)	MLU	TTR	Results of Symbolic Play Assessment	Hearing Impairment	Visual Impairment	Behavior Problem
S1	61	F	Black	23	30	1 3	0 52	Spontaneous agent play & object substitution	None	None	None
S2	76	F	Black	30	30	3.02	0.37	Imitatsd agent play & spontaneous object substitution	None	None	None
S3	78	F	Black	27	25.5	2 62	0_44	Spontaneous agent play & object substitution	None	None	None
S4	62	F	Caucasian	30	31.5	2.72	0.41	Verbally prompted agent play & object substitution	None	None	None

tha following 10 minutes, the researcher provided action models, verbal cues and instructions. The researcher modeled more advanced symbolic behaviors (e.g., agent play, object substitution) than those exhibited spontaneously by the subject. The subject's play behaviors were coded in three modes: (a) spontaneous symbolic play; (b) symbolic play following a verbal or physical cue by the researcher (e.g., 'Make the doctor check the baby'); and (c) symbolic play following a demonstration of the behavior by the researcher. The subject's play behaviors were videotaped and analyzed using a scale of play levels developed from the taxonomies of McCune-Nicolich (1981) and Watson and Fischer (1980). All subjects showed some emerging preplanning symbolic behaviors such as agent play and object substitution play. Specifically, two subjects (Subject 1 & 3) showed spontaneous animate-agent play (e.g., Child makes the doll walk) but no inanimate-agent play (e.g, Child makes the block walk). Two subjects (Subject 2 & 4) showed animate-agent play only with the examiner's verbal cues or demonstration.

In addition, two procedures were instituted to insure the appropriateness of the lexical stimuli to be used in the treatment. In the first procedure, individual lexical items (e.g., nouns, verbs) to be used in the experimental stimuli but not targeted for training were tested prior to the study. This procedure was conducted to insure that the subjects' performance on stimuli was not affected by their lack of

lexical knowledge. In this test, the subject was asked to point to or act on objects (e.g., 'Point to a ball,' 'Kiss the ball'). Those verbs and nouns that the subject fails to respond to correctly were trained until 100% correct responding is established. All of these words were trained in one pretreatment session for all subjects. Secondly, subjects were tested for their knowledge of locatives that would be targeted in the stimuli. This procedure was administered to insure that the target locatives (on top of, under, in front of, next to) were appropriate for the subjects' developmental level but had yet to be mastered by the subjects. Each of these targeted locatives was tested in a probable sentence (e.g., 'Put the block on top of the chair'). All subjects failed to respond correctly to three out of four target locatives in these probable sentences.

Further, the auditory comprehension portion of the Preschool Language Scales (PLS) (Zimmerman, Steiner, & Evatt, 1969) was administered to assess the subject's receptive language ability. The auditory comprehension ages of the subjects ranged from 25 1/2 to 31 1/2 months.

An expressive language sample was also collected to assess the subject's productive language ability. Fifty utterances were collected during free play. First, the mean length of utterances (MLU) (# of morphemes/# of utterances) was calculated for each subject. Subject 2 showed the longest length of utterances (MLU=3.02), while Subject 1 showed the

shortest length of utterances (MLU=1.3). Secondly, the type token ratio (TTR) (# of different morphemes/total # of morphemes) was calculated to assess variety of the utterances for each subject. TTR's for Subjects 1, 2, 3, and 4 were 0.52, 0.37, 0.44, and 0.41, respectively. The subjects' utterances were analyzed further according to their distribution of semantic relations using the protocol described by McDonald (1978) Subject 1's utterances were characterized by three semantic-grammatical rules (SGR): modifier-head, action-object, and introducer-X. The utterances of other three subjects were characterized by seven semantic-grammatical rules: action-object, agent-action, agent-object, introducer-X, modifier-head, negation-X, and X-location. Each subject's semantic-grammatical rules are presented in Appendix A.

Experimental Stimuli

The subjects were asked to act out the stimulus items. The number of correct responses out of 8 possible responses were recorded. Eight training items and eight generalization items were used for each target behavior (i.e., agent-action-object, action-object-locative) in both conditions (i.e., script, nonscript). Thus, the verbal items in the two conditions were comprised of: (a) eight "agent-action-object" training items; (b) eight "agent-action-object" generalization items; (c) eight "action-object-locative" training items; and (d) eight "action-object-locative" generalization items. To insure a reliable assessment of subjects' language

comprehension, the "agent-action-object" items consisted of four original items (e.g., 'Make Mickey kiss the cup') and their reversed items (e.g., 'Make the cup kiss Mickey'). Both original items and their reversed items consisted of four types of sentences based on animacy of the agent and object: (a) animate-animate (+,+) sentence (e.g., 'Make Mickey wash the baby'); (b) animate-inanimate (+,-) sentence (e.g., 'Make Mickey kiss the cup'); (c) inanimate-animate (-,+) sentence (e.g., 'Make the cup kiss Mickey'); and (d) inanimate-inanimate (-,-) sentence (e.g., 'Make the stick smell the flower'). To reduce the dependence of the data on the subject's probable-event strategy to act out "action-object-locative" sentences, the "action-object-locative" also consisted of four original sentences (e.g., 'Put the cup on top of the ice box') and four reversed sentences (e.g., 'Put the ice box on top of the cup'). The four locatives chosen for this study were "on top of," "under," "in front of," and "next to." The verbal commands included the carrier phrases such as 'Make the _____.' and 'Put the _____.' for "agent-action-object" constructions and "action-object-locative" constructions, respectively. Examples of these verbal probe items are shown in Appendix B.

In addition to the probe items, six nonscorable commands were used to encourage the subject to complete the target routine in the script conditions. The same number of nonscorable commands (i.e., 6) were also used to insure the subject's attention to the task in the nonscript contexts.

These nonscorable commands used by the researcher were comprised of simple "action-object" construction (e.g., 'Open the box.'); in which, the subject was the agent of the action. Examples of these nonscorable commands are shown in Appendix C.

Procedures

Experimental Design

This study employed a single subject, alternating-treatments design (ATD, Barlow & Hayes, 1979) in combination with a multiple-baseline design across subjects to assess the effects of the two language comprehension treatments, script-based treatment and nonscript-based treatment. The alternating-treatments design was used to evaluate the relative effects of each treatment on language comprehension within each subject, while the multiple baseline design across subjects was included for control purposes.

This study involved three phases: (a) baseline (Phase 1), (b) experimental phase for both script and nonscript treatment (Phase 2), and (c) maintenance phase (Phase 3). During the experimental phase, the alternating-treatments design was implemented. The two treatments were applied alternatively to comprehension of "agent-action-object" constructions and "action-object-locative" constructions. During the maintenance phase, both treatments on the two target constructions ("agent-action-object" and "action-object-locative") were withdrawn and only maintenance data on these behaviors were collected. Following is a description of each phase of the design.

Baseline Baseline data were collected to determine the subject's language comprehension of semantic constructions prior to treatment. Both the training and generalization items were presented to the child in both contexts (script, nonscript). In the script context, actions were temporally sequenced and organized around a theme. To insure that the results would not demonstrate the effect of a particular activity on language comprehension intervention, three routines or activities (popcorn-making, pudding-making, milkshake-making) were used in the script context. These activities were altered across sessions. In the nonscript context, on the other hand, actions had no thematic or temporal sequences. To balance the variety of the materials between the two contexts, three sets of nonscript activities (Activities 1, 2, 3) were used. Fifteen objects were randomly arranged into three sets of activities and altered across sessions.

Each subject was asked to act out verbal commands comprised of the "agent-action-object" or "action-object-locative" constructions in each assigned context. No modeling or feedback were given for correct or incorrect responses. This phase was continued until stable baseline data are established. Simultaneous initiation of the two treatments (script, nonscript) was sequenced across subjects until all subjects were in treatment. Treatments were started with Subject 1 after four baseline sessions, subject 2 after five baseline sessions,

subject 3 after six baseline sessions, and subject 4 after seven baseline sessions.

Phase 2 The alternating-treatments design was implemented in this phase. The order of presentation of the two treatments was controlled across time periods and subjects (see Appendix D). To control for possible carry-over effects of the two treatments, each treatment was applied to a different target construction. For example, the "agent-action-object" semantic construction was assigned to script-based treatment while the "action-object-locative" semantic construction was assigned to nonscript-based treatment for Subject 1. The assignment of treatments for Subject 1 was replicated for Subject 3 while the assignment for Subject 2 was replicated for Subject 4. Thus, to control for possible differential acquisition effects for the two target constructions, the assignment of treatments on the two semantic constructions was reversed for the two groups of subjects (i.e., Subject 1 & 3 vs. 2 & 4). The assigned treatment and target constructions for each subject are summarized in Table 2. This phase of the study was terminated when each subject responded correctly to one of the assigned target constructions with more than 75% accuracy in three consecutive sessions or when the subject completed 20 training sessions.

Table 2. Summary of Experimental Phase 2: Subject, Treatment, and Target Behavior

	Phase 2: Alternating Treatments Design (ATD)	
Subject	Treatment Condition	Target Behavior
S1	Script	Agent-Action-Object
	Nonscript	Action-Object-Locative
S2	Script	Action-Object-Locative
	Nonscript	Agent-Action-Object
S3	Script	Agent-Action-Object
	Nonscript	Action-Object-Locative
S4	Script	Action-Object-Locative
	Nonscript	Agent-Action-Object

Phase 3 During this phase of the study, three maintenance data points for each condition were collected for three of the four subjects. Due to her prolonged absence, only two maintenance data for each condition was collected for Subject 1. Without modeling or feedback, both training items and generalization items were tested in this phase.

Training Procedures

Each training session took approximately 20 minutes and was divided into two cycles: (a) probing (Cycle 1) and (b) training (Cycle 2). Each training session took approximately 20 minutes. During the first cycle, both training and generalization items were tested without modeling or feedback. Generalization items requested the subjects to act on different objects from the training items. During the second cycle, the target constructions (e.g., "agent-action-object") were trained with an assigned treatment as shown in Table 2. For each correct response, the subject received a reinforcer (e.g., sticker) with the researcher's verbal praise (e.g., 'good job,' 'right'). For the subject's incorrect response, the researcher provided a physical cue (e.g., pointing), demonstration, or physical prompt (i.e., physical assistance for the subject's performance), which were arranged hierarchically. Examples of scoring sheets for this phase are presented in Appendix E. Following is a description of each treatment procedure

Script-Based Treatment Script-based treatment is founded on the script theory which provides guidelines for the content of the nonlinguistic features of intervention events. Based on script literature, the script-based treatment is presumably designed to provide subjects with a predictable cognitive context to facilitate language comprehension. Three similar routines (popcorn-making, pudding-making, milkshake-making) were developed and used for script-based treatment contexts in this study. These scripts were chosen since they have natural end products (i.e., popcorn, pudding, milkshake), which keep the child's interest and encourage completion of the activity. Each routine or script consisted of several subscripts. For the popcorn-making script, for example, putting corn into popcorn maker, operating popcorn maker, putting butter on popcorn, eating the popcorn, and drinking juice were correspondent subscripts. See Table 3 for script organization for each routine. To prevent the subject from becoming bored with these routine events, there were some planned variations across sessions (e.g., flavors of the juice, pudding, and milkshake). Materials for each context are shown in Appendix F.

The researcher introduced the script-based treatment by saying, "We are going to make _____." During training (Cycle 2), the researcher used six routine phrases to establish strong sequential, causal script organizations. For example, the researcher said, "The baby is dirty" prior to the

Table 3 Script Organizations of Three Activities

Script	Subscripts	Actions
Popcorn-Making	1. Putting popcorn into popcorn maker	A. Open a popcorn jar. B. Pour the popcorn into a popcorn maker
	2. Operating popcorn maker	A. Put on the top of the popcorn maker. B. Plug in the cord
	3. Putting butter on popcorn	A. Put the popcorn into a plate B. Cut the butter with a knife. C. Put the butter on the popcorn.
	4. Eating popcorn	A. Eat the popcorn. B. Clean hands with a napkin.
	5. Drinking juice	A. Open a box. B. Take a juice bottle out of the box. C. Shake the juice bottle. D. Open the juice bottle E. Pour the juice into a cup. F. Drink the juice from the bottle.
Pudding-Making	1. Putting pudding powder into mixer	A. Open a pudding powder bag. B. Pour the powder into a mixer.
	2. Putting milk into mixer	A. Pour milk into a cup from a milk bottle. B. Pour milk into the mixer from the from the cup.
	3. Operating mixer	A. Plug in the cord. B. Push "on" button.

Table 3--continued

Script	Subscripts	Actions
Pudding-Making		C. Push "off" button
	4. Eating pudding	A. Pour the pudding into a cup. B. Eat the pudding with a spoon.
	5. Drinking juice	A. Open a box. B. Take a juice bottle out of the box. C. Shake the juice bottle. D. Open the juice bottle. E. Pour the juice into a cup. F. Drink the juice from the bottle.
Milkshake-Making	1. Putting ice cream into mixer	A. Get a scoop of ice cream. B. Pour the ice cream into a mixer.
	2. Putting milk into mixer	A. Pour milk into a cup from a milk bottle. B. Pour milk into the mixer from the from the cup
	3. Operating mixer	A. Plug in the cord. B. Push "on" button C. Push "off" button
	4. Eating pudding	A. Pour the milkshake into a cup. B. Eat the milkshake with a spoon.
	5. Drinking juice	A. Open a box. B. Take a juice bottle out of the box. C. Shake the juice bottle. D. Open the juice bottle. E. Pour the juice into a cup. F. Drink the juice from the bottle.

command, "Make Mickey wash the baby." Examples of the researcher's phrases are shown in Appendix C. Positive reinforcements (verbal praises & stickers) were given for the child's correct responses while physical cues (e.g., pointing), demonstrations, or physical prompts were provided for the child's incorrect responses.

Nonscript-Based Treatment In nonscript-based treatment the subject was also be asked to act on objects. However, there were no thematic or goal-oriented sequences among training actions. The sequence of the training items in nonscript treatment were randomly arranged each session to avoid the possibility that the nonscript-based training actions become a routinized event to the child. The number and the complexity of training items used in this treatment were similar to those in script-based treatment (See Appendix E). As in script-based treatment, three sets of nonscript activities (Activities 1, 2, 3) were alternated across treatment sessions.

The researcher introduced the nonscript treatment by saying, "We are going to play with these toys." The researcher placed four objects, two in each of two rows, in front of the subject and asked her to act out the researcher's commands. To insure the subject's attention to the task, the researcher used six nonscorable commands. For example, the researcher said, "Give me a hammer" prior to the command, "Make Burt kiss the hammer" (see Appendix C). As in script-

based treatment, verbal praises and reinforcement were given for the subject's correct responses and physical cues, modelling or physical prompts were given for the incorrect responses.

Reliability

Dependent Variable All sessions were videotaped and scored on a plus (+), minus(-) basis from the tape. Interjudge reliability were obtained during baseline (i.e., Phase 1), experimental phases of each treatment (i.e., Phase 2), and maintenance (i.e., Phase 3) for all subjects. An independent observer watched the videotapes and scored one third of all the data collected from baseline, treatment, and maintenance phases. The interjudge reliability (# of agreed items/total # of items) was 83%.

Independent Variable The interjudge reliability for the independent variable was obtained on one arbitrarily selected session during each treatment for each subject. An independent observer scored the researcher's behaviors during the second cycle of treatment sessions (i.e., training cycle). The experimenter's behaviors were scored based on (a) number of verbal stimuli per session and (b) accuracy of feedback. The number of verbal stimuli was tallied by each observer. The accuracy of the experimenter's feedback was be scored on a plus (+), minus (-) basis. A plus (+) was given when the experimenter provided appropriate verbal praise for the child's correct response or when the experimenter provided

appropriate modeling or physical prompting for the child's incorrect response. A minus (-) was given for any other response-feedback pattern. The interjudge reliabilities for the number of verbal stimuli and the accuracy of the reinforcement were 98% and 95% respectively.

RESULTS

Number of correct responses to each of 8 stimuli was recorded for each condition. Each subject's responses are visually demonstrated in Figures 1-4 and summarized in Tables 4-7. In addition, trend lines for each subject's changes, using a split-middle method (White & Haring, 1980), are exhibited in Appendix G. Each subject's performance across the three phases of the study are discussed below.

Subject 1

Baseline

For Subject 1, four baseline probes were administered prior to introduction of the treatment. In the script condition, the number of correct responses to 8 stimuli averaged 1.5 with a range from 1 to 2 for both training and generalization items. In the nonscript condition, the number of correct responses to 8 stimuli averaged 1.0 with a range from 0 to 2 for the training items and averaged 0.25 with a range from 0 to 1 for the generalization items. The child's responses showed stable trends in the script generalization items and nonscript training items. Although slightly accelerating trends were observed in the script training items and nonscript generalization items, changes in number of

correct responses did not exceed 1. Overall, stable baselines were established during Phase 1.

Acquisition

Script Treatment During Phase 2, Subject 1 was trained to comprehend "agent-action-object" semantic constructions in the script treatment condition. Prior to the treatment cycle, the subject's ability to act-out the targeted semantic constructions was assessed. Subject 1's responses to the targeted semantic constructions in the script treatment condition reached criterion level within 15 treatment sessions.

The data presented in Figure 1 show a clearly accelerating trend in the number of correct responses to each stimulus with the introduction of script treatment. The number of correct responses to 8 stimuli during the treatment phase averaged 4.87 with a range from 2 to 7 while it averaged 1.5 with a range from 1 to 2 during the baseline phase. There was only a 6.7% (1 out of 15) overlap in the number of correct act-outs between the baseline and treatment phase. These data indicate that introduction of script treatment resulted in a clear acquisition effect on the "agent-action-object" construction.

Nonscript Treatment During Phase 2, Subject 1 was trained to act-out "action-object-locative" semantic constructions in the nonscript treatment condition. While her responses to "agent-action-object" semantic construtions in

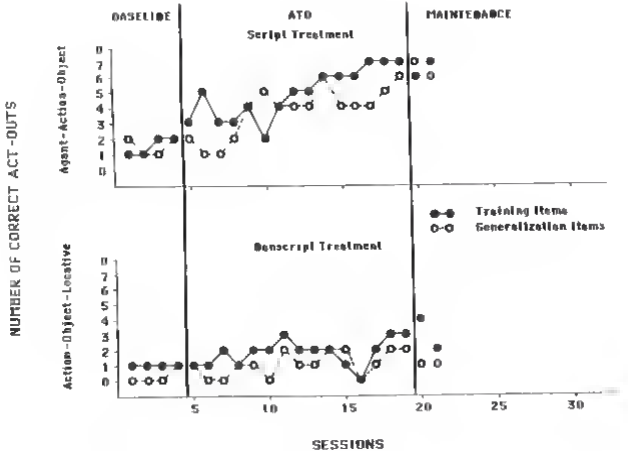


Figure 1. Summary of Subject 1's Data for Training Items and Generalization Items in Two Treatments.

the script treatment condition reached criterion level, Subject 1's responses to the "action-object-locative" semantic constructions in the nonscript treatment condition did not reach criterion level within 15 sessions. As shown in Figure 1, only slight positive change was observed after introduction of nonscript treatment. The number of correct responses to 3 stimuli during the nonscript treatment phase averaged 2.04 with a range from 0 to 3. Compared to the average of 1.0 during the baseline phase, only a slight positive change was observed after the introduction of nonscript treatment. There was a 33.3% overlap (5 out of 15) between the two phases. The data indicate that introduction of nonscript treatment resulted in only a slight acquisition effect for the "action-object-locative" construction.

Generalization

During Phase 1, Subject 1's ability to comprehend targeted semantic constructions for both training stimuli and generalization stimuli was assessed. Response generalization effects were determined by examination of the child's responses to untrained items representing the targeted semantic construction. During Phase 2, Subject 1's ability to respond to untrained items for the targeted construction in both script and nonscript contexts was assessed. Although her responses to the script training items reached criterion level, Subject 1's responses to generalization items in both

the script and nonscript contexts did not reach criterion level within 15 sessions.

The data presented in Figure 1 show accelerating trends in both script and nonscript generalization data. However, the trend for the script generalization data was greater than the trend for the nonscript generalization data. The number of correct responses to each of 8 script generalization stimuli during Phase 2 averaged 3.67 with a range from 1 to 6 while it averaged 1.5 with a range from 1 to 2 during the baseline phase. There was a 26.7% (4 out of 15) overlap in the number of correct act-outs between Phase 1 and 2. These data indicate that the introduction of script treatment resulted in a clear generalization effect on the "agent-action-object" construction.

The number of correct responses to each of 8 nonscript generalization items during Phase 2 averaged 1.04 with a range from 0 to 2. Compared to the average of 0.25 during the baseline phase, only a slight positive change was observed after the introduction of nonscript treatment. There was a 66.7% overlap (5 out of 15) between the two phases. The data indicate that the introduction of nonscript treatment resulted in only a slight generalization effect on the "action-object-locative" construction

Maintenance

Maintenance effects of treatment were determined by examination of the child's responding to treatment and

generalization probe items during Phase 3. For Subject 1, two maintenance data points were collected for each treatment. The subject's mean correct responses to the "agent-action-object" script training items were 1.5 during baseline, 7.0 over last two training sessions and 6.5 during maintenance (Phase 3). The subject's mean correct responses to the "agent-action-object" script generalization items were 1.5 during baseline, 5.5 over last two training sessions and 6.5 during maintenance. As seen in Figure 1, maintenance data for both script training and generalization items were slightly lowered from treatment data but superior to baseline data.

In analysis of nonscript maintenance data, the subject's mean correct responses to the "action-object-locative" nonscript training items were 1.0 during baseline, 3.0 over last two training sessions and 3.0 during maintenance. The data indicate that the responses to nonscript training items were maintained at the treatment level during the maintenance phase. The subject's mean correct responses to nonscript generalization items were 0.25 during baseline, 2.0 over last two training sessions and 1.0 during maintenance. Responses to nonscript generalization items were lowered from the treatment level but slightly superior to the baseline level.

Summary of Subject 1's Data

Subject 1's data for all three phases are summarized in Table 4. During Phase 1, stable or slightly accelerating

baselines were established in both script and nonscript conditions. Data from Phase 2 clearly show acquisition and generalization effects of script treatment on the "agent-action-object" construction. On the other hand, only slight improvement was observed in Subject 1's training and generalization data after the introduction of nonscript treatment on the "action-object-locative" construction. The results indicate that the script treatment was more effective than the nonscript treatment in facilitating acquisition and generalization of targeted responses for Subject 1. During Phase 3, the number of correct responses were slightly lowered from the treatment level, but superior to the baseline level in all conditions except the nonscript training condition. Subject 1's responses to nonscript training items remained at the treatment level.

Subject 2

Baseline

For Subject 2, five baseline probes were administered prior to introduction of the treatment. In the script condition, the number of correct responses to each of 8 stimuli averaged 1.2 with a range from 1 to 2 for the training items and averaged 1.0 with a range from 0 to 2 for the generalization items. In the nonscript condition, the number of correct responses to each of 8 stimuli averaged 0.6 with a range from 0 to 1 for the training items and averaged 1.2 with a range from 1 to 2 for the generalization items. A

Table 4 Summary of Visual Analysis[a] Subject 1

	Phase			Phase I Baseline	Phase II Treatments S (Agt-Act-Obj)	Phase II Treatments N-S (Act-Obj-Loc)	Phase III Maintenance
1	Phase Length	S[a]	TI[b]	4	15	15	2
			GI[c]	4	15	15	2
		N-S[d]	TI	4	15	15	2
			GI	4	15	15	2
2	Mean Level & Range	S	TI	1.5 (1-2)	4.87 (2-7) 7.00[e]		6.5 (6-7)
			GI	1.5 (1-2)	3.67 (1-6) 5.50		6.5 (6-7)
		N-S	TI	1.0 (0-1)		2.04 (0-3) 3.00	3.0 (2-5)
			GI	0.25 (0-1)		1.04 (0-2) 2.00	1.0 (1-1)
3	Estimate of Trend Direction	S	TI	/ (+)	/ (+)		
			GI	- (=)	/ (+)		
		N-S	TI	- (=)		- (=)	
			GI	/ (+)		/ (+)	
4.	% of Overlap	S	TI		6.7%		
			GI		26.7%		
		N-S	TI			33.3%	
			GI			66.7%	

[a]Script Condition
[b]Training Items
[c]Generalization Items
[d]Nonscrit Condition
[e]Mean of Last Two Training Sessions

stable trend was observed in the nonscript training data. A slightly accelerating trend was observed for the script generalization data while slightly descending trends were observed for the script training data and nonscript generalization data. Although slightly accelerating and decelerating trends were observed during the baseline phase, changes in number of correct responses did not exceed 2. Therefore, the data indicate that stable baseline was established during Phase 1.

Acquisition

Script Treatment During Phase 2, Subject 2 was trained to act-out "action-object-locative" semantic constructions in the script treatment condition. Subject 2's treatment phase extended to 20 sessions since her responses did not meet the level. The data presented in Figure 2 show a positive change in the number of correct responses to each of 8 stimulus with the introduction of script treatment. The number of correct responses to 8 stimuli during the treatment phase averaged 3.95 with a range from 2 to 7 while it averaged 1.2 with a range from 1 to 2 during the baseline phase. There was a 20% (4 out of 20) overlap in the number of correct act-outs between the baseline and treatment phase. Although the acquisition effect for the script treatment was not as powerful as for Subject 1, the data demonstrate that introduction of script treatment resulted in an acquisition

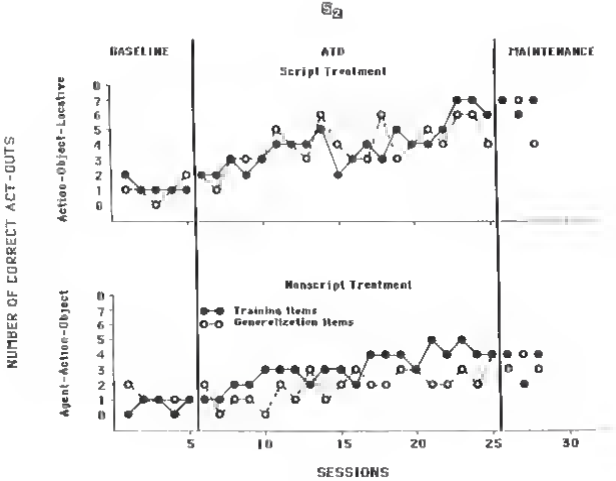


Figure 2. Summary of Subject 2's Data for Training Items and Generalization Items in Two Treatments.

effect on Subject 2's responses to "agent-action-object" constructions.

Nonscript Treatment During Phase 2, Subject 2 was trained to act-out "agent-action-object" semantic constructions in the nonscript treatment condition. As in the case of the script treatment, Subject 2's responses to the targeted construction in the nonscript treatment did not reach the criterion level within 20 treatment sessions.

As shown in Figure 2, a positive change was observed in the number of correct responses to the nonscript training items. The number of correct responses to 8 stimuli during the nonscript treatment phase averaged 3.10 with a range from 2 to 5 as compared to the average of 0.6 with a range from 0 to 1 during the baseline phase. There was a 10% overlap (2 out of 20) between the two phases. When compared to the average of 3.95 with a range from 2 to 7 in the script treatment condition, however, the acquisition effect of the nonscript treatment was not as clear as the acquisition effect of the script treatment. The data indicate that the introduction of nonscript treatment resulted in a positive acquisition effect on the "action-object-locative" construction; however, the nonscript treatment showed a less powerful acquisition effect than the script treatment.

Generalization

During Phase 1, the child's comprehension of "action-object-locative" and "agent-action-object" constructions were

assessed in the script and nonscript contexts, respectively. The data presented in Figure 2 show accelerating trends in both script and nonscript generalization data. The number of correct responses to each of 8 script generalization stimuli during the treatment phase averaged 3.90 with a range from 1 to 6 while it averaged 1.0 with a range from 1 to 2 during the baseline phase. There was a 10% (2 out of 20) overlap in the number of correct act-out between Phase 1 and 2. These data indicate that introduction of script treatment resulted in a clear generalization effect on the "action-object-locative" construction.

The number of correct responses to each of 8 nonscript generalization items during the treatment phase averaged 1.95 with a range from 0 to 4. Compared to the average of 1.2 with a range from 1 to 2 during the baseline phase, a slight positive change was observed after the introduction of nonscript treatment. There was a 70% overlap (14 out of 20) between the two phases. The data indicate that introduction of nonscript treatment resulted in only a slight generalization effect on the "agent-action-object" construction. Therefore, the generalization effect of the script treatment was slightly more powerful than that of the nonscript treatment.

Maintenance

For Subject 2, three maintenance data points were collected for each treatment. The subject's mean correct

responses to the "action-object-locative" script training items were 1.2 during baseline, 6.5 over last two training sessions and 6.7 during maintenance. Similarly, the subject's mean correct responses to the script generalization items were 1.0 during baseline, 5.0 over last two training sessions and 6.0 during maintenance. The subject's mean correct responses to the "agent-action-object" nonscript training items were 0.6 during baseline, 4.0 over last two training sessions and 3.3 during maintenance. The subject's mean correct responses to the "agent-action-object" nonscript generalization items were 1.2 during baseline, 3.0 over last two training sessions and 3.3 during maintenance. The data indicate that Subject 2's maintenance data for both script and nonscript items were slightly superior or inferior to the treatment level.

Summary of Subject 2's Data

Subject 2's data for all three phases are summarized in Table 5. During Phase 1, stable baselines were established in all conditions. Although the acquisition criterion level was not met within 20 training sessions (Phase 2) in both the script and nonscript treatment conditions, both treatments demonstrated acquisition effects on Subject 2's comprehension of the targeted semantic constructions with greater acquisition effect of the script treatment. The generalization data also indicate that the script treatment resulted in slightly more powerful generalization effect than the nonscript treatment. Phase 3 data indicate that Subject

Table 5. Summary of Visual Analysis: Subject 2

Phase			Phase I Baseline	Phase II Treatments S	Phase II Treatments N-S (Act-Obj-Loc)	Phase II Treatments N-S (Agt-Act-Obj)	Phase III Maintenance
1. Phase Length	S[a]	TI[b]	5	20	20		3
		GI[c]	5	20	20		3
	N-S[d]	TI	5	20	20		3
		GI	5	20	20		3
2. Mean Level & Range	S	TI	1.2 (1-2)	3.95 (2-7) 6.50[e]			6.7 (6-7)
		GI	1.0 (0-2)	3.90 (1-6) 5.00			6.0 (4-7)
	N-S	TI	0.6 (0-1)		3.10 (2-5) 4.00		3.3 (2-4)
		GI	1.2 (1-2)		1.95 (0-4) 3.00		3.3 (3-4)
3. Estimate of Trend Direction	S	TI	\ (-)	/ (+)			
		GI	/ (+)	/ (+)			
	N-S	TI	- (=)		/ (+)		
		GI	\ (-)		/ (+)		
4. % of Overlap	S	TI		20.0%			
		GI		10.0%			
	N-S	TI			10.0%		
		GI			70.0%		

[a]Script Condition
[b]Training Items
[c]Generalization Items
[d]Nonscript Condition
[e]Mean of Last Two Training Sessions

2's responses to both script and nonscript items were slightly superior or inferior to the levels of those during the training phase.

Subject 3

Baseline

For subject 3, six baseline probes were administered prior to introduction of the treatment. In the script condition, the number of correct responses to each of 8 stimuli averaged 1.67 with a range from 1 to 2 for the training items and averaged 1.0 with a range from 0 to 2 for the generalization items. In the nonscript condition, the number of correct responses to each stimulus averaged 1.67 with a range from 1 to 2 for the training items and averaged 1.33 with a range from 0 to 2 for the generalization items. A stable trend was observed for the script generalization data and slightly descending trends were observed in the other three conditions. However, changes in the number of correct responses did not exceed 2. Overall, the data in Analysis 1 indicate that stable baseline was established during Phase 1.

Acquisition

Script Treatment As in the Subject 1's case, Subject 3 was trained to act-out "agent-action-object" semantic constructions in the script treatment condition. Subject 3's responses to the targeted semantic constructions in the script treatment condition reached criterion level within 14 treatment sessions.

The data presented in Figure 3 show a sharply accelerating trend in the number of correct responses to each stimulus with the introduction of script treatment. The number of correct responses to 8 stimuli during the treatment phase averaged 5.36 with a range from 2 to 8 while it averaged 1.67 with a range from 1 to 2 during the baseline phase. There was only a 7% (1 out of 14) overlap in the number of correct act-outs between the baseline and treatment phase. These data indicate that introduction of script treatment resulted in a clear acquisition effect of the "agent-action-object" construction.

Nonscript Treatment As in the Subject 1's case, Subject 3 was trained to act-out "action-object-locative" semantic constructions in the nonscript treatment condition. While her responses to the targeted constructions in the script treatment condition reached criterion level, Subject 3's responses to the targeted constructions in the nonscript treatment condition did not reach criterion level within 14 sessions. As shown in Figure 3, a slight positive trend with some variations is observed in the number of correct responses to the nonscript training items. The number of correct responses to 8 stimuli during nonscript treatment phase averaged 2.29 with a range from 1 to 4. Compared to the average of 1.67 with a range from 1 to 2 during the baseline phase, only a slight positive change was observed after the introduction of nonscript treatment. There was a 64.3%

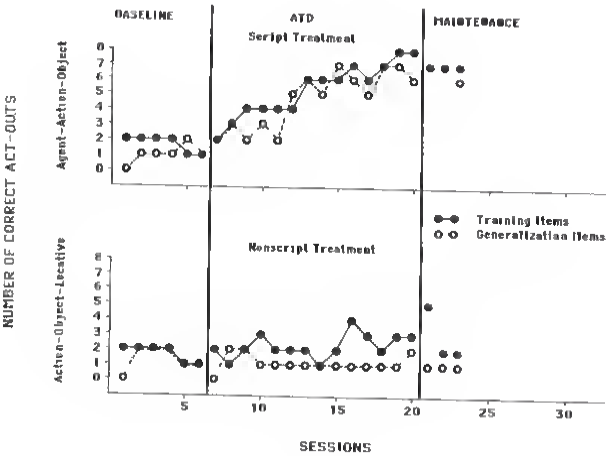


Figure 3. Summary of Subject 3's Data for Training Items and Generalization Items in Two Treatments

overlap (9 out of 14) between the two phases. The data indicate that the introduction of nonscript treatment did not result in a clear acquisition effect on the "action-object-locative" construction.

Generalization

Although her responses to the script training items reached the acquisition criterion level, Subject 3's responses to the generalization items in both the script and nonscript contexts did not reach the criterion level within 14 sessions. The data presented in Figure 3 show a accelerating trend in the script generalization data. The number of correct responses to each of 8 script generalization stimuli during the treatment phase averaged 4.36 with a range from 2 to 7 while it averaged 1.00 with a range from 1 to 2 during the baseline phase. There was a 21.4% (3 out of 14) overlap in the number of correct out-puts between Phase 1 and 2. These data indicate that introduction of script treatment resulted in a clear generalization effect on the "agent-action-object" construction.

The number of correct responses to each of 8 nonscript generalization items during the treatment phase averaged 1.14 with a range from 1 to 2. Compared to the average of 1.33 during the baseline phase, no change was observed after the introduction of nonscript treatment. There was a 100% overlap (14 out of 14) between the two phases. The data indicate that the introduction of nonscript treatment resulted in no

generalization effect on the "action-object-locative" construction. Thus, the script treatment was more effective on generalization than the nonscript treatment.

Maintenance

For Subject 3, three maintenance data points were collected for each treatment. The subject's mean correct responses to the "agent-action-object" script training items were 1.67 during baseline, 8.0 over last two training sessions and 7.0 during maintenance. As seen in Figure 3, maintenance data for the training items during the maintenance phase were slightly inferior to those during the training phase but superior to those during the baseline phase. The subject's mean correct responses to the script generalization items were 1.0 during baseline, 6.5 over last two training sessions and 6.7 during maintenance. The responses to the script generalization items during the maintenance phase were maintained at a level of those during the training phase. Therefore, the data indicate that the child's responses to both script training and generalization items were maintained slightly superior or inferior to the treatment level.

In analysis of nonscript data, the subject's mean correct responses to the "action-object-locative" training items were 1.67 during baseline, 3.0 over last two training sessions and 3.0 during maintenance. The subject's mean correct responses to the nonscript generalization items were 1.33 during baseline, 1.5 during maintenance and 1.0 during maintenance.

These nonscript data indicate that Subject 3's responses to the training items were maintained at the treatment level and superior to the baseline level while those to the generalization items were lowered to the baseline level.

Summary of Subject 3's Data

Subject 3's data for all three phases are summarized in Table 6. During Phase 1, stable baselines were obtained. During Phase 2, Subject 3's responses in the script treatment condition reached the acquisition criterion level within 14 treatment sessions, while only a slightly positive changes were observed in the nonscript treatment condition. Therefore, script treatment resulted in much more powerful acquisition effect on Subject 3's comprehension of the targeted semantic constructions. Further, a clear generalization effect was demonstrated in the script treatment condition, while no generalization effect was demonstrated in the nonscript treatment condition. During Phase 3, Subject 3's responses were maintained at a level commensurate with or slightly inferior to the level of responses observed during the training phase in all but the nonscript generalization condition where responses fell below baseline level.

Subject 4

Baseline

For subject 4, seven baseline probes were administered prior to introduction of the treatment. In the script condition, the number of correct responses to each of 8

Table 6 Summary of Visual Analysis, Subject 3

Phase			Phase I Baseline	Phase II Treatments S (Agt-Act-Obj)	Phase II Treatments N-S (Act-Obj-Loc)	Phase III Maintenance
1. Phase Length	S[a]	TI[b]	6	14	14	3
		GI[c]	6	14	14	3
	N-S[d]	TI	6	14	14	3
		GI	6	14	14	3
2. Mean Level & Range	S	TI	1.67 (1-2)	5.36 (2-8) 8.00[e]		7.0 (7-7)
		GI	1.0 (0-2)	4.36 (2-7) 6.50		6.7 (6-7)
	N-S	TI	1.67 (1-2)		2.29 (1-4) 3.00	3.0 (2-5)
		GI	1.33 (0-2)		1.14 (1-2) 1.50	1.0 (1-1)
3. Estimate of Trend Direction	S	TI	\ (-)	/ (+)		
		GI	- (=)	/ (+)		
	N-S	TI	\ (-)		/ (+)	
		GI	\ (-)		- (=)	
4. % of Overlap	S	TI		7.0%		
		GI		21.4%		
	N-S	TI			64.3%	
		GI			100.0%	

[a]Script Condition
[b]Training Items
[c]Generalization Items
[d]Nonscript Condition
[e]Mean of Last Two Training Sessions

stimuli averaged 0.86 with a range from 0 to 1 and 0.57 with a range from 0 to 1 for the training items and generalization items, respectively. In the nonscript condition, the number of correct responses to each stimulus averaged 1.43 with a range from 0 to 2 for the training items and averaged 1.57 with a range from 0 to 4 for the generalization items. A stable trend was observed for the script training data only. In all of the conditions, decelerating trends were observed.

Acquisition

Script Treatment As in the Subject 2's case, Subject 4 was trained to act-out "action-object-locative" semantic constructions in the script treatment condition. Subject 4's responses to the targeted constructions in the script treatment condition reached criterion level within 17 treatment sessions.

The data presented in Figure 4 show a positive change in the number of correct responses to each stimulus with the introduction of script treatment. The number of correct responses to 8 stimuli during the treatment phase averaged 4.29 with a range from 1 to 8 while it averaged 0.86 with a range from 0 to 1 during the baseline phase. There was only a 5.8% (1 out of 17) overlap in the number of correct act-outs between the baseline and treatment phase. The data indicate that introduction of script treatment resulted in a clear acquisition effect on the "action-object-locative" construction.

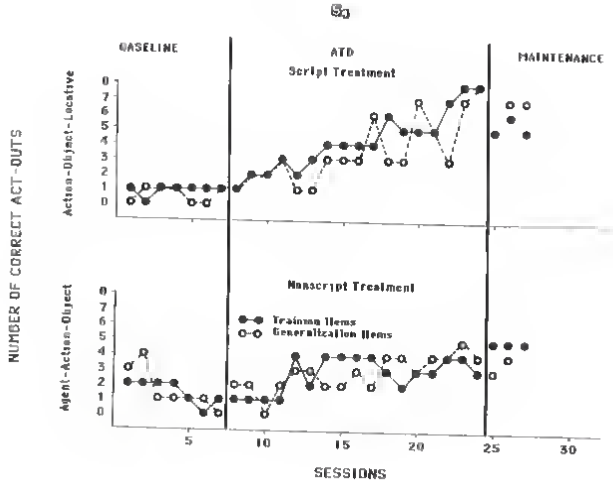


Figure 4: Summary of Subject 4's Data for Training Items and Generalization Items in Two treatments.

Nonscript Treatment As in the Subject 2's case, Subject 4 was trained to act-out "action-object-locative" constructions in the nonscript treatment condition. While her responses to the targeted constructions in the script treatment condition reached criterion level, Subject 4's responses to the "agent-action-object" constructions in the nonscript treatment condition did not reach criterion level within 17 sessions. In analysis of the nonscript treatment data, only slightly positive changes were observed

As shown in Figure 4, only a slight positive change in the number of correct responses to each stimulus was observed. The number of correct responses to 8 stimuli during the nonscript treatment phase averaged 2.82 with a range from 1 to 4. Compared to the average of 1.43 with a range from 0 to 2 during the baseline phase, a positive change was observed after the introduction of nonscript treatment. There was a 35.3% overlap (6 out of 17) between the two phases. The data indicate that the introduction of nonscript treatment resulted in only a slight positive acquisition effect on the "action-object-locative" construction. When compared to the average of 4.29 with a range from 1 to 8 in the script treatment, it is noted that the nonscript treatment showed a less powerful acquisition effect than the script treatment.

Generalization

The data presented in Figure 4 show an accelerating trend for the script generalization data. The number of correct

responses to each of 8 script generalization stimuli during the treatment phase averaged 3.59 with a range from 1 to 8 while it averaged 0.57 with a range from 0 to 1 during the baseline phase. There was a 17.6% (3 out of 17) overlap in the number of correct act-oute between Phases 1 and 2. These data indicate that introduction of script treatment resulted in a clear generalization effect on the "action-object-locative" construction.

As in the script generalization condition, an accelerating trend was observed for the nonscript generalization data. The number of correct responses to each of 8 nonscript generalization items during the treatment phase averaged 2.** with a range from 0 to 5. Compared to the average of 1.57 with a range from 0 to 4 during the baseline phase, only a slight positive change was observed after the introduction of nonscript treatment. There was a 94.1% overlap (16 out of 17) between the two phases. The data indicate that the introduction of nonscript treatment resulted in only a slight generalization effect on the "agent-action-object" construction. The script treatment showed a more powerful generalization effect than the nonscript treatment.

Maintenance

For Subject 4, three maintenance data points were collected for each treatment. The subject's correct responses to the "action-object-locative" script training items were 0.88 during baseline, 8.0 over last two training

sessions and 5.3 during maintanance. As seen in Figure 4, correct numbers of the responses to the script training items were maintained at a level inferior to those in the treatment phase but superior to those in the baseline phase. The subject's mean correct responses to the script generalization items were 0.57 during baseline, 7.5 over last two training sessions and 6.3 during maintenance. The data indicate that the responses to the script generelization items were maintained at a level slightly inferior to those in the treatment phase.

The subject's mean correct response to the "agent-action-locative" nonscript training items were 1.43 during baseline, 3.5 over last two training sessions and 5.0 during maintenance. The subject's mean correct responses to the "agent-action-locative" responses to the nonscript generalization items were 1.57 during baseline, 4.5 over last two training sessions and 4.0 during maintenance. As seen in Figure 4, Subject 4's responses to the nonscript training items were maintained at a level superior to those in the treatment phase while the responses to the nonscript generelization items were maintained at a level slightly inferior to those during the treatment phase but superior to those in the baseline phase.

Summary of Subject 4's Data

Subject 4's data for all three phases are summarized in Table 7. Stable or decelereting baselines were obtained

Table 7. Summary of Visual Analysis: Subject 1

Phase			Phase I Baseline	Phase II Treatments S (Act-Obj-Loc)	Phase II Treatments N-S (Act-Act-Obj)	Phase III Maintenance
1. Phase Length	S[a]	TI[b]	7	17	17	3
		GI[c]	7	17	17	3
	N-S[d]	TI	7	17	17	3
		GI	7	17	17	3
2. Mean Level & Range	S	TI	0.86 (0-1)	4.29 (1-8) 8.00[e]		5.3 (5-6)
		GI	0.57 (0-1)	3.59 (1-8) 7.50		6.3 (5-7)
	N-S	TI	1.43 (1-2)		2.82 (1-4) 3.50	5.0 (5-5)
		GI	1.57 (0-4)		2.88 (1-5) 4.50	4.0 (3-5)
3. Estimate of Trend Direction	S	TI	- (=)	/ (+)		
		GI	\ (-)	/ (+)		
	N-S	TI	\ (-)		/ (+)	
		GI	\ (-)		/ (+)	
4. % of Overlap	S	TI		5.8%		
		GI		17.6%		
	N-S	TI			35.3%	
		GI			94.1%	

[a]Script Condition
[b]Training Items
[c]Generalization Items
[d]Nonscript Condition
[e]Mean of Last Two Training Sessions

during Phase 1. Subject 4's responses in the script treatment condition reached criterion level within 17 treatment sessions, while her responses in the nonscript treatment condition demonstrated only slight positive changes. Thus, the script treatment resulted in more powerful acquisition effects than the nonscript treatment. Similarly, a clear generalization effect for the script treatment was observed, while only a slight positive change was observed in the nonscript treatment condition. Subject 4's responses during Phase 3 were slightly lower when compared to response levels during treatment in all but one condition. In the nonscript treatment condition of Phase 3, her responses were maintained at a level superior to those during the treatment phase.

Response Pattern Analyses for "Agent-Action-Object" Constructions

The subject's comprehension of the "agent-action-object" semantic constructions were analyzed in terms of the accuracy of their responses and their response strategies used four types of animacy constructions represented by the stimulus patterns: (a) Pattern 1 (animate agent, animate object) sentence (e.g., 'Make Mickey wash the baby'); (b) Pattern 2 (animate agent, inanimate object) sentence (e.g., 'Make Mickey kiss the cup'); (c) Pattern 3 (inanimate agent, animate object) sentence (e.g., 'Make the cup kiss Mickey'); and (d) Pattern 4 (inanimate agent, inanimate object) sentence (e.g., Make the stick smell the flower). First, each subject's

correct responses were analyzed to examine whether the child has any response pattern preference for the animacy combinations represented (e.g., if subject responded correctly more often to inanimate agent, animate object constructions than other constructions) and if these patterns changed throughout the treatment sessions. Secondly, each subject's incorrect responses were analyzed to examine whether the child used specific error response strategies (e.g., child-as-agent strategy) with specific construction types (e.g., animate agent, animate object).

Analysis of Comprehension Accuracy for Sentence Pattern Types across Baseline and Treatment Sessions

Subject 1

During four baseline sessions, Subject 1 performed correctly most frequently to Pattern 3 (inanimate agent, animate object) sentences with a mean of 8 out of 12 (67%) correct responses, while Pattern 2 (animate agent, inanimate object) sentences were never responded to correctly (see Table 8). The number of correct responses to Pattern 1 sentences increased most throughout the treatment sessions, followed by Pattern 2 sentences. During the last third of treatment sessions, the child responded correctly to Pattern 1, 3, 2, and 4 sentences, in that order.

Subject 2

During five baseline sessions, Subject 2 performed most correctly to Pattern 1 (animate agent, animate object)

Table 8 Correct Responses across Treatment Sessions: Subject 1

Sentence Patterns	Items	Base-line	Treatment Sessions																	Total
		S1-4	1	2	3	4	5	Total	6	7	8	9	10	Total	11	12	13	14	15	Total	
Pattern 1: Animate Agent (+), Animate Object (+)	G[a]	1	0	0	0	0	1	1	2	1	2	2	2	9	2	2	2	2	2	10	
	T[b]	0	0	2	0	1	0	3	0	0	2	2	2	6	2	2	2	2	2	10	
	Total	1						4						15						20	39
Pattern 2: Animate Agent (+), Inanimate Object (-)	G	0	0	0	0	0	0	0	1	1	1	1	1	5	0	0	2	2	1	5	
	T	0	1	1	1	1	0	4	1	1	1	1	2	6	1	1	2	2	2	8	
	Total	1						4						11						13	28
Pattern 3: Inanimate Agent ( ), Animate Object (+)	G	4	1	1	0	1	1	4	1	1	0	0	2	4	1	1	0	0	2	4	
	T	4	1	1	1	0	2	5	1	2	2	2	1	8	2	2	1	2	2	9	
	Total	8						9						12						13	34
Pattern 4: Inanimate Object (-), Inanimate Object (-)	G	1	1	0	1	1	2	5	1	1	1	1	1	5	1	1	0	1	1	4	
	T	2	1	1	1	1	2	6	0	1	0	0	1	2	1	1	2	1	1	6	
	Total	3						11						7						10	31

[a]Generalization
[b]Training

sentences with a mean of 6 out of 9 (67%) correct responses, while Pattern 4 (inanimate agent, inanimate object) sentences were never responded correctly (see Table 9). The number of correct responses to Pattern 2 sentences increased rapidly during the first third of treatment sessions. The number of correct responses to Pattern 1 and 3 sentences increased during the second third of treatment sessions. Finally, Pattern 4 responses increased during the last third of treatment sessions.

Subject 3

During six baseline sessions, Pattern 3 sentences (inanimate agent, animate object) performed most accurately with a mean of 8 out of 18 (44%) correct responses, while Pattern 1 (animate agent, animate object) sentences were never responded to correctly (see Table 10). During the first third of treatment sessions, the numbers of correct responses to Pattern 1 and 2 sentences increased rapidly. During the second third of treatment sessions, the numbers of correct responses to Pattern 1 and 3 sentences were most rapidly increased. During the last third of treatment sessions, the subject responded equally correctly to Patterns 1 and 2, followed by Patterns 4 and 3.

Subject 4

During seven baseline sessions, Subject 4 performed most accurately to Pattern 4 (inanimate agent, inanimate object) sentences with a mean of 9 out of 23 (39%), while Pattern 2

Table 9: Correct Responses across Treatment Sessions- Subject 2

Sentence Patterns	Items	Base-line	Treatment Sessions																				Total
		B1-5	1	2	3	4	5	6	7	Total 1-7	8	9	10	11	12	13	14	Total 8-14	15	16	17	18	19	20	Total 15-20	
Pattern 1: Animate Agent (+), Animate Object (+)																										
Pattern 2: Animate Agent (+), Inanimate Object (-)																										
Pattern 3: Inanimate Agent (-), Animate Object (+)																										
Pattern 4: Inanimate Agent (-), Inanimate Object (-)																										

[a]Generalization
[b]Training

Table 10 Correct Responses across Treatment Sessions: Subject 3

Sentence Pattern	Items	Baseline B1-6	Treatment Sessions 1	2	3	4	5	Total	6	7	8	9	10	Total	11	12	13	14	Total	Total
Pattern 1: Animate Agent (+), Animate Object (+)	G[a]	0	0	0	1	1	2	4	1	2	1	2	2	8	2	2	2	2	8	
	T[b]	0	0	0	1	1	1	3	2	1	2	2	2	9	2	2	2	2	8	
	Total							7						17					16	
Pattern 2: Animate Agent (+), Inanimate Object (-)	G	0	0	1	1	0	1	3	1	2	1	1	1	6	1	1	2	2	6	
	T	5	1	2	2	1	2	8	2	2	1	2	2	9	2	2	2	2	8	
	Total							11						15					14	
Pattern 3: Inanimate Agent (-), Animate Object (+)	G	4	1	2	0	1	0	4	2	2	2	2	1	9	2	2	1	1	6	
	T	4	0	1	0	1	1	3	1	2	2	1	2	8	0	2	2	2	6	
	Total							7						17					12	
Pattern 4: Inanimate Agent (-), Inanimate Object (-)	G	4	1	0	0	1	0	2	0	1	1	2	2	6	0	2	2	2	6	
	T	1	1	0	1	1	1	4	1	1	1	1	1	5	2	1	2	2	7	
	Total							6						11					13	

[a]Generalization
[b]Training

(animate agent, inanimate object) sentences were never responded to correctly (see Table 11). The number of correct responses to Pattern 2 and Pattern 4 sentences increased rapidly during the second third of treatment sessions. During the last third of treatment sessions, Pattern 2 sentences were responded correctly most often, followed by Pattern 1 and 4 sentences.

Summary of Comprehension Accuracy

In summary, the results of the subjects' comprehension accuracy for pattern sentence types demonstrate no consistent response pattern across all subjects. However, it is noted that three subjects (Subject 1, 3, 4) responded more correctly to Pattern 3 (inanimate agent, animate object) sentences than Pattern 2 (animate agent, inanimate object) sentences. Subject 2 responded to these two sentence patterns with a comparable rate of accuracy. These results are consistent with the findings from McClellan et al. (1986) who reported that errors on animate-inanimate sentences (e.g., Girl bump car) were significantly greater than inanimate-animate sentences (e.g., Car bump girl) in 2-year-old children's comprehension.

Analysis of Error Strategies

The subjects' incorrect responses were analyzed to examine the types of error response patterns exhibited for the "agent-action-object" constructions. Seven possible response alternatives were possible for each of 4 sentence patterns

Table 11 Correct Responses through Treatment Sessions: Subject 4

Sentence Pattern	Items	Baseline	Treatment Sessions																		Total
		B1-7	1	2	3	4	5	6	Total T1-7	7	8	9	10	11	12	Total T8-12	13	14	15	16	17	Total T13-17	T1-17
Pattern 1																							
Animate Agent (+), Animate Object (+)	G[a]	4														4						6	
	T[b]	4	1	1	0	1	2	0	5	1	1	1	1	1	0	5	0	0	2	0	1	3	
	Total																						
Pattern 2																							
Animate Agent (+), Inanimate Object (-)	G		0																				
	T	0				0				1	2						1	2	1		1		
	Total		0																				
Pattern 3																							
Inanimate Agent (-), Animate Object (+)	G	5								0							2	1	0				
	T	5								1							1		1	2			
	Total																						
Pattern 4																							
Inanimate Agent (-), Inanimate Object (-)	G																						
	T	4								1	1	1	1				1	1	1	1			
	Total																						

[a] Generalization
[b] Training

(animate-animate, animate-inanimate, inanimate-animate, inanimate-inenimate). Those alternatives were (a) animate agent, animate object (e.g., 'Mickey kisses the bear'); (b) animate agent, inanimate object (e.g., 'The bear kisses the cup'); (c) inanimate agent, animate object (e.g., 'The cup kisses Mickey'); (d) inanimate agent, inanimate object (e.g., 'The cup kisses the block'); (e) self agent, animate object ('The child kisses Mickey'); (f) self agent, inanimate object ('The child kisses the cup'); and (g) no response or incorrect action. Data on error strategies are summarized in Table 12.

Subject 1

For Subject 1, 52 error responses were analyzed. Pattern 1 (animate agent, animate object) sentences were often substituted by self-agent responses or the same animacy pattern responses using incorrect items. For Pattern 2 (animate agent, inanimate object) sentences, the subject either used self to act on inanimate objects responses or inanimate-animate response patterns. For Pattern 3 (inanimate agent, animate object) sentences, the subject always used self-inanimate response patterns. Pattern 4 (inanimate agent, inanimate object) sentences were substituted by various response patterns. Subject 1's error responses patterns indicate that she often used herself as an agent across sentence patterns.

Table 12. Error Response Pattern of Agent-Action-Object

Verbal Stimuli (Agent, Object)	Error Response	Subjects				Total (%)
Pattern 1	Animate (+), Animate (+)	3	10	0	1	14 (19%)
Animate Agent (+),	Animate (+), Inanimate (-)	0	0	0	0	0
Animate Object (+)	Inanimate (-), Animate (+)	0	0	0	0	0
	Inanimate (-), Inanimate (-)	0	0	0	0	0
	Self (#). Animate (+)	12	3	22	16	53 (74%)
	Self (#). Inanimate (-)	0	0	0	0	0
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Pattern 2	Animate (+), Animate (+)	0	0	0	0	0
Animate Agent (+),	Animate (+), Inanimate (-)	0	0	5	0	5 (6%)
Inanimate Object (-)	Inanimate (-), Animate (+)	8	8	8	7	32 (40%)
	Inanimate (-), Inanimate (-)	0	0	0	0	0
	Self (#). Animate (+)	0	1	0	1	2 (2%)
	Self (#). Inanimate (-)	8	7	2	5	22 (27%)
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Pattern 3	Animate (+), Animate (+)	0	0	0	0	0
Inanimate Agent (-),	Animate (+), Inanimate (-)	0	1	7	1	9 (14%)
Animate Object (+)	Inanimate (-), Animate (+)	0	0	4	0	4 (6%)
	Inanimate (-), Inanimate (-)	0	0	0	0	0
	Self (#). Animate (+)	0	13	2	2	17 (26%)
	Self (#). Inanimate (-)	8	3	1	4	16 (25%)
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Pattern 4	Animate (+), Animate (+)	0	0	0	0	0
Inanimate Agent (-),	Animate (+), Inanimate (-)	2	0	3	0	5 (7%)
Inanimate Object (-)	Inanimate (-), Animate (+)	5	1	1	0	7 (10%)
	Inanimate (-), Inanimate (-)	3	0	4	7	14 (20%)
	Self (#). Animate (+)	0	0	0	0	0
	Self (#). Inanimate (-)	3	18	8	11	40 (56%)
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Subject 2

For Subject 2, 70 error responses were analyzed. Pattern 1 (animate agent, animate object) sentences were often substituted by same animacy response pattern with incorrect items or occasionally by self-agency response pattern. For Pattern 2 (animate agent, inanimate object) sentences, Subject 2 often confused the agent and object roles. In addition, she often used herself as an agent of these sentences. Self-agency responses were also predominant in Pattern 3 (inanimate agent, animate object) sentences. For Pattern 4 (inanimate agent, inanimate object) sentences, the subject often used self-agency responses.

Subject 3

For Subject 3, 78 error responses were analyzed. For Pattern 1 (animate agent, animate object) sentences, the subject frequently used herself as an agent. For Pattern 2 (animate agent, inanimate object) sentences, the subject predominately used inanimate-animate (-,+) and animate-inanimate (+,-) responses. The subject's responses to Pattern 3 (inanimate agent, animate object) sentences indicate that she was sometimes confused between agent and object roles and sometimes used herself as an agent. In response to Pattern 4 (inanimate agent, inanimate object) sentences, the subject predominantly used the self-agency responses, followed by the inanimate-inanimate (-,-) error pattern.

Subject 4

For Subject 4, 89 error responses were analyzed. Subject 4 usually used herself as an agent for Pattern 1 sentences. For Pattern 2 (animate agent, inanimate object) sentences, she often responded using incorrect actions or she confused the agent and object roles. Self-agency and no response/incorrect actions were the predominant error responses used for Pattern 3 sentences. Pattern 4 sentences were very frequently substituted by the self-agency responses, followed by the same animacy with incorrect items responses.

Summary of Error Response Analysis

Across subjects, the most predominant error response was the self-agency pattern (e.g., 'Child kisses the cup when asked to make 'Mickey kiss the cup'), followed by agent-object reversals (e.g., Child makes 'the cup kiss Mickey' when asked to make 'Mickey kiss the cup') and substitutions with same animacy pattern using incorrect items (e.g., Child makes 'the baby kiss the cup' when asked to make 'Mickey kiss the cup').

Table 13 summarizes the subjects' comprehension strategies using the following categorizations as described in the literature: (a) child-as-agent strategy, (b) agent-object reversal, (c) inanimate-animate pattern preference, and (d) probable-event strategy. The child-as-agent strategy was coded when the child used self as an agent (e.g., child smells flower when the examiner asks child to make cer smell the

Table 13 Summary of Error Analysis Across Subjects

Comprehension Strategies	Description	Frequency of Occurrence			
		S1	S2	S3	S4
1. Child-as-Agent	The child uses herself as an agent (e.g., 'The child smells the flower' when asked to make 'the car smell the flower').	31	47	37	39
2. Agent-Object Reversal	The child reverses an agent-object relation (e.g., The child makes 'the cup kiss Mickey' when asked to make 'Mickey kiss the cup').	12	16	19	12
3. Probable-Event Strategy	The child acts out probable sentences when asked to act out improbable sentences (e.g., The child makes the 'the baby smells the popcorn' when asked to make 'the cup smell the popcorn).	5	7	14	8
4. Inanimate agent-Animate object (-,+) Preference	The child acts out inanimate agent-animate object (-,+) for (a) animate-animate (+,+) sentences, (b) animate-inanimate (+,-) sentences, or (c) inanimate-inanimate (-,-) sentences.	6	10	15	6

flower). Agent-object reversal was coded when the child responded similarly to an original sentence. All four subjects frequently reversed the agent and object roles in Pattern 2 (animate-inanimate) sentences while only Subject 3 showed frequent agent-object role reversals in Pattern 3 (inanimate-animate) sentences. The probable-event strategy was coded when the child acted out probable sentences after the examiner presented improbable sentences. This strategy was coded when the child substituted an inanimate agent with an animate toy (e.g., Child makes the baby smells the popcorn when asked to make the cup smell the popcorn) or when the child used a scented toy (e.g., flower, pudding) as a patient of a sentence (e.g., Child makes the stick smell the flower when asked to make the flower smell the stick). The inanimate-animate (-,+) sentence (e.g., cup kisses Mickey) preference was observed when the child acted out an inanimate-animate (-,+) sentence (e.g., cup kisses Mickey) for other types of sentences such as (a) an animate-animate (+,+) sentence (e.g., Mickey kiss bear), (b) an animate-inanimate (+,-) sentence (e.g., Mickey kisses cup), or (c) an inanimate-inanimate (-,-) sentence (cup kisses the spoon).

Summary of the Findings

Overall, baseline data for all four subjects showed stable or slightly accelerating trends (for three subjects) and decelerating trends (for one subject) during Phase 1. With the introduction of Phase 2 script treatment, all 4

subjects showed clearly positive acquisition effects for their comprehension of the target semantic constructions. All subjects except Subject 2 met criterion level within 20 treatment sessions. Although the number of correct responses for all subjects increased after the introduction of nonscript treatment, none of the subjects met the acquisition criterion level within 20 treatment sessions. The acquisition data indicate that script treatment resulted in greater acquisition effects on comprehension of semantic construction than the nonscript treatment.

The data from three subjects show that the number of correct responses to generalization items increased as the number of correct responses to training items increased in both script and nonscript treatment; however, smaller increments of change were observed in nonscript treatment. Overall, the generalization data of all subjects indicate that the script treatment was more effective on generalization than the nonscript treatment.

During Phase 3, maintenance data for the script and nonscript conditions showed that correct responses to the training items slightly decreased from treatment level but were maintained at a level superior to baseline. In the script treatment, the number of correct responses to generalization items were maintained at treatment level or decreased slightly but superior to baseline level. However, for the nonscript treatment, some of the maintenance data

dropped to baseline level. The subjects showed individual patterns of response accuracy for the four type of agency constructions. However, analysis of their incorrect responses on the "agent-action-object" construction revealed similar error response patterns with self-agency as the predominant pattern across subjects. The number of the four subjects' correct responses in the two treatment conditions are summarized in Figure 5 (a composit of Figures 1-4).

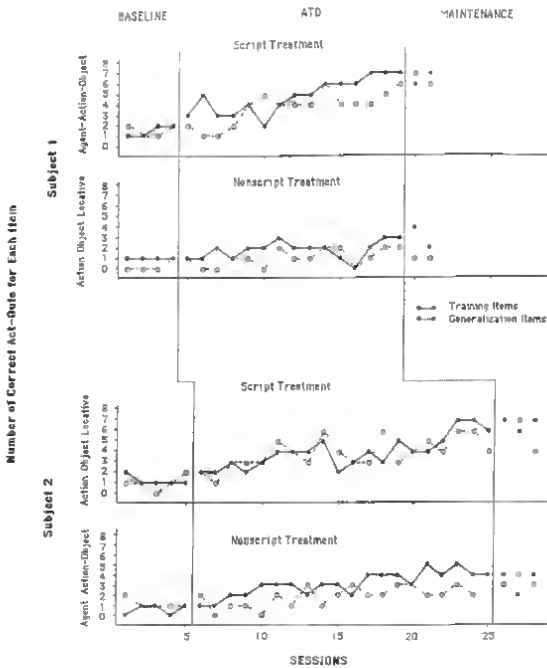


Figure 5. Number of Correct Act-Outs to Two Semantic Relation Commands.

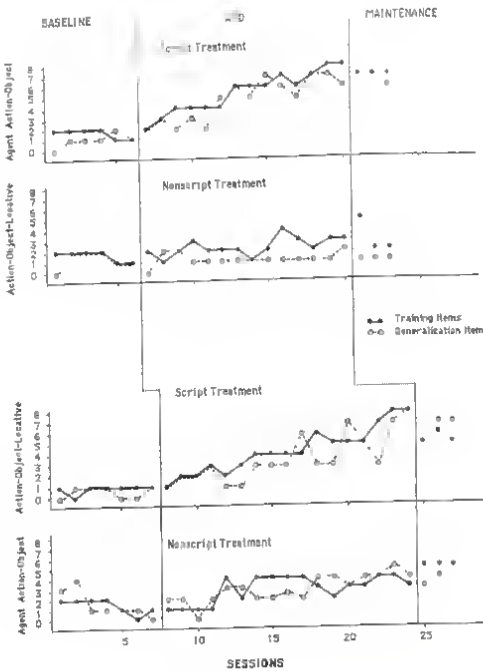


Figure 5. continued

DISCUSSION

The purpose of this study was to investigate the acquisition, generalization and maintenance effects of training trainable mentally handicapped preschoolers to comprehend three-word semantic constructions in script treatment and nonscript treatment conditions. Script treatment context was derived from the Nelson's general event knowledge theory which posits that events organized in sequential, routinized contexts should facilitate the child's predictability of situation-specific utterances and, in turn, facilitate conjoining cognitive contexts and situation-specific utterances. The nonscript treatment context was used to reflect a more traditional language comprehension treatment paradigm. In the script treatment condition, each action item was sequentially organized around one of three routines (e.g., popcorn-making, pudding-making, milkshake-making) and repeated throughout the treatment sessions while each action item in nonscript treatment was independently presented in a random order. Correct number of responses to each stimulus item was recorded for each treatment. The two developmentally similar semantic constructions (agent-action-object & action-object-locative) were served as stimuli in this study and were

presented in standard (e.g., Make Mickey kiss the cup) and reversed (e.g., Make the cup kiss Mickey) forms in both script and nonscript contexts. In addition, animacy of agent and object of sentence was systematically varied in the "agent-action-object" construction. Subjects' error responses to the "agent-action-object" semantic construction were further analyzed to examine their use of comprehension strategies.

Results from the present study demonstrated clear acquisition and generalization effects of script treatment on the subjects' comprehension of the target semantic constructions. Changes after script treatment were greater than those after nonscript treatment for all four subjects. For Subjects 1, 2 and 3, the acquisition criterion level (more than 75% accuracy in 3 consecutive sessions) was met only in the script treatment condition within 20 sessions. Although Subject 4's responses did not reach criterion within 20 sessions for either of the treatment conditions, her correct responses increased more rapidly in the script condition. Similarly, changes in generalization data after script treatment were greater than those after nonscript treatment for all four subjects. Although it is difficult to discuss with certainty maintenance effects of the treatments since only two or three maintenance data points were collected for each subject, the subjects' comprehension of target semantic constructions were maintained at a training level or slightly lower level.

Acquisition Effect of Script Treatment

It was clearly demonstrated that script treatment was effective in facilitating the subjects' receptive language. Several characteristics of script context, such as sequential organization, routinized actions, and causal relationships among actions, seem to contribute to its acquisition effect on language comprehension. During the later training sessions, subjects sometimes demonstrated evidence that they could readily predict the next action and/or verbal stimulus in the treatment routine. For example, Subject 4, who was trained an "action-object-locative" construction in the script condition, said 'Put the knife next to the spoon' after the researcher put the spoon on the table but before the researcher present the verbal stimulus, 'Put the knife next to the spoon.' Similarly, Subject 1, who was trained on "agent-action-object" construction, fed baby and said, 'dirty' before the researcher presented the verbal stimulus, 'Make Micksy wash the baby.'

Training data for all subjects in the script condition showed progressive acquisition trends during the initial training sessions and sharp acquisition trends during later training sessions. This initial, progressive change indicates that it takes some time for the child to be familiar with a script and perceive it's hierarchical and sequential organization. The sharp change trends during later sessions support general event knowledge principle that the script

organization helps the child to reduce his/her cognitive load since it is organized sequentially and repetitively and thereby allows the child to focus more on the situational language than the sequence of events.

The researcher's use of verbal cues and routinized phrases, as well as the availability of contextual cues seem to be an another important factor for the acquisition effect of script treatment. In this study, for example, the researcher said, 'Mickey is dirty' after the child fed Mickey and before the researcher asked the child to make the baby wash Mickey. These routinized phrases seemed to be important in establishing a strong script structure, especially during initial sessions.

Although all subjects showed greater comprehension acquisition in the script condition, slightly better acquisition effects were observed for the "agent-action-object" construction than for the "action-object-locative" construction. Subject 1 and Subject 3, who were trained on the "agent-action-object" construction, met the acquisition criterion level within 14 and 15 sessions respectively, while Subject 2 and Subject 4, who were trained on the "action-object-locative" construction, did not meet the acquisition criterion level until 17 and 20 sessions respectively. These slightly different acquisition effects might be explained by the nature of the specific scripts used for each target construction in this study. Subscript actions for the scripts

developed for the "agent-action-object" construction seem to be more causaiiy organized than those for the "action-object-iocative" construction. Thus, the scripthese of the "agent-action-object" constructions seems to be slightly stronger than for the "action-object-locative" constructions in this study. For example, in a script routine for the "agent-action-object" conetruction, 'Mickey kisses the cup' because he loves the cup then 'The oup kisses Mickey' to return Miokey's kiss. In the script routine for the "notion-object-iocative" construction, the examiner etstes, 'Put the spoon next to the fork' and then 'Put the fork next to the spoon'. Aithough the researcher provided some verbai ciues such as 'The spoon wants to be with the fork' or 'The fork wants to be with the spoon' in this script, the strength of the causal reistionship for this construction wae more diffiouit to eatabiish Another possibie explanation for the different acquisition effects between the two groups of subjects (Subject 1 & 3, Subject 2 & 4) might be found in the subjects' leveis of symbolic piay. In the symboiic play assessment sdministered prior to this study, Subject 1 snd 3 showed spontaneous agent-play behaviors whiie Subject 2 and 4 showed agent-piay behaviors only after the eaaminer'e demonstration or verbal/physical cues (see Tabie 1).

In conclusion, results of this study demonstrated strength of the script context as a superordinate struoture since oiear acquisition effects of script-based treatment were

established across construction types (e.g., agent-action-object) and routines (e.g., popcorn-making, pudding-making, milkshake-making).

Generalization of Script Treatment

In addition to acquisition effects, generalization effects of script treatment were clearly demonstrated in this study. Findings from the generalization data indicate that the subjects were able to act-on appropriately untrained commands (e.g., 'The bear kiss the cup') that were identical in construction to those commands used during training (e.g., 'Mickey kiss the cup'). However, it should be noted that the sequential organization of the scripts was identical for the training and generalization probes. For example, animate agent kisses the inanimate object (e.g., Mickey/bear kisses the cup) followed by inanimate object kisses the animate agent (e.g., The cup kisses Mickey or bear) sequences were used in both the training and generalization probes. Therefore, future studies need to determine whether similar generalization effects maintain when other sequences of routines are used for generalization.

Since the degree of scriptness can be systematically changed, it might be effective to include variations in scripts for effective generalization. Variations can be made in target structures, subscript actions, or exemplars. For example, the clinician can add more target structures in a script (e.g., adjectives in addition to locatives), add more

actions or changes in subscripts (e.g., washing dishes after eating snacks), or provide different objects for same actions (e.g., bear for Mickey). However, it may be important to introduce these variations only after the child is familiar with unaltered scripts.

In this study, three routines (popcorn-making, pudding-making, milkshake-making) were alternatively used for script treatment. Although these activities were different, their script organizations were similar and they shared a common theme (i.e., sequential actions for making a snack). Although the actions for each script were slightly different, the subjects did not appear confused or distracted by these variations. The subjects' adaptability to and success with the various routines suggests that they established a general event knowledge about these scripts which they readily transferred across routines. However, the subjects did show preference among these activities and were observed to pay more attention to the researcher during their favorite activity. The subjects' activity preferences, however, did not result in noticeable differences in their performance. Instead, the alternation in routines seemed to motivate the subjects to participate in the training sessions. Using several different but functionally similar scripts may be a useful methodology for facilitating generalization.

Maintenance data were collected approximately one week after the termination of treatment. The number of correct

responses in script context remained at approximately the same level for Subjects 1 and 2, slightly dropped for Subject 3, and clearly dropped for Subject 4 when compared to the training data. Script treatment data did not show a superior maintenance effect when compared to the nonscript treatment data. Also, the subjects' performance on the maintenance probe did not correspond to the number of training sessions they required to meet the criterion. Since these findings are based only two or three data points, further research is needed to investigate the maintenance issue.

Analysis System for Language Comprehension Treatment

In the single-scoring system used in this study, a credit was given when the child responded correctly to each original or reversed sentence. Therefore, the subject's number of correct acts-outs for each stimulus item was scored. However, several other scoring systems were suggested in the literature. For example, Miller (in prase) suggested to give a credit only when the child responded correctly to both an original and its reversed sentence. Compared to the single-scoring system, the paired-scoring system seems to be more restricted and thereby minimizes the possibility of overcrediting the child for guessing. When the investigator used the paired-scoring system the data showed clear acquisition and generalization effects in the script treatment but only slight or no acquisition effects were observed in the nonscript treatment condition. These results using the

paired-scoring system are visually exhibited in Appendix C. Only the single-scoring system was used to describe the data in this study because the total number of responses in the paired-scoring system was smaller (i.e., 4) for observing the subjects' learning process when compared to the single-scoring system (i.e., 8). The single-scoring system may be more useful in examining how the child's comprehension changes over time as a function of treatment while the paired-scoring system seems to be more useful for assessing performance at a single point in time. If some positive changes are demonstrated in the single-scoring but not in the paired-scoring system, in the case of using both systems, the changes may be interpreted as indicating emerging rather than acquired behavior.

Another alternative for scoring children's language comprehension is to analyze each element of semantic construction (e.g, action, locative, object, agent), separately. For example, 2 points may be given when the child makes " Mickey kiss the baby" after the examiner requests the child to make "Mickey kiss the cup", 1 for a correct agent and 1 for a correct action. This system might be sensitive to each element of semantic construction and allow the clinician to analyze which element of the construction needs to be trained.

Error Patterns for "Agent-Action-Object" Comprehension

Results from the children's responses patterns revealed four dominant comprehension strategies: (a) child-as-agent strategy, (b) agent-object reversal, (c) probable-event strategy, and (d) inanimate-animate pattern preference. The child-as-agent strategy reported in many studies with young children (Sinclair & Bronckart, 1972; de Villiers & de Villiers, 1973, Bridges, 1980) was the most dominant error pattern for all subjects. Most recently, Harrison et al. (1989) observed this error pattern as a dominant comprehension strategy for normal children between 2 and 2 1/2 years of age. Agent-object reversal (e.g., child makes 'the cup kiss Mickey' when the examiner asks child to make 'Mickey kiss the cup'), which was second most frequent error pattern for all subjects, indicates that the child understands agency but he/she is not sure about the relationship between agent and object in a sentence. The probable-event strategy, which has been documented (Chapman & Kohn, 1978) as a commonly used response that precedes use of a word-order strategy, was the third most common response pattern for three subjects. The forth most common response pattern observed in this study was the use of the inanimate-animate (-,+) sentence (e.g., cup kisses Mickey) for the animate-inanimate (+,-) sentences (e.g., Mickey kisses cup).

Analysis for the children's correct response pattern demonstrated that three subjects responded more correctly to inanimate-animate (-,+) sentences than animate-inanimate (+, -) sentences. This finding is consistent with the finding from McClellan et al. study (1986) that errors on animate-inanimate sentences were significantly greater than inanimate-animate sentences. However, this phenomenon is difficult to explain in terms of cognitive strategies documented in the literature such as the probable-event strategy (Chapman & Kohn, 1978), the animate-agent strategy (Chapman & Miller, 1975), or the dynamic-agent strategy (Lempert, 1978). This response pattern might be related to the size of the manipulated toys since inanimate items used in this study were slightly smaller than animate items. Children tended to assign agency to smaller items (e.g., cup) while larger items (e.g., Mickey) were more likely to serve as patients or objects. Another possible explanation is based on the observations of children's symbolic play behaviors. In symbolic play assessment settings, children tend to bring inanimate toys (e.g., food, bottle) to animate toys (e.g., baby-doll, animal-doll).

Clinical Implications

Finding from this study clearly demonstrate that script-based treatment is more effective in the acquisition and generalization of language comprehension for specific constructions than traditional, nonscript-based treatment.

Several clinical advantages of script-based treatment were noted in this study. First, script-based context seems to help the child to bridge between a situation and situational language. This, in turn, facilitates the comprehension of language. Secondly, the degree of scriptness can be systematically controlled, allowing the clinician to begin treatment with a strong, routinized script and then gradually and systematically vary the elements of the script. It seems to be important that at least during the early training sessions, the subscript actions are repeated in a same order. During the later training sessions, the script organization might be varied or expanded. Applying variations in script seems to facilitate generalization effect. Further, the flexibility of script organization allows the clinician to control the degree of scriptness based on the child's acquisition trend.

Future Research

Additional experimental research may add clarity to the present results. The following areas of research have been noticed to be important for future investigations of script treatment.

1) Direct replication of the present study should be undertaken to determine whether these results are indicative of the behavior of trainable mentally handicapped preschoolers.

2) Systematic replication of the present study across language disorders should be undertaken to determine whether these results are representative of the behavior of other language-impaired populations.

3) Systematic replication of the present study for language production should be undertaken to determine whether script treatment is effective on language production.

4) Situation generalization of treatment effects should be further analyzed to determine whether these results are representative in different context or routines. Such research might assist in bridging the gap between acquisition and maintenence.

5) Variables related to facilitating generalization across responses and stimuli should be examined. Such research might assist in bridging the gap between acquisition and generalization

6) Maintenance effects of script treatment should be further examined with extended maintenance sessions.

7) Relationship between the child's level of symbolic play and the degree of changes on his/her language comprehension in script treatment should be examined.

APPENDIX A

SPONTANEOUS LANGUAGE SAMPLE AND SEMANTIC-GRAMMATICAL RULES

SUBJECT 1

Child's Utterances	Semantic-Grammatical Rules
1. Hello	
2. Hello	
3. Hello	
4. It me	
5. Now you	
6. Hello	
7. Hello	
8. Yeah	
9. Yeah	
10. You	
11. bye	
12. Oh, phone	
13. Hello	
14. His	
15. Bye-bye	
16. No	
17. Yeah	
18. Yeah	
19. No, no, no	
20. Yeah	
21. Know me	Action + Object
22. Bye	

23. Yeah	
24. Know me	Action + Object
25. Oh, my food	Modifier + Head Possession
26. Oh, oh	
27. My bottle	Modifier + Head Possession
28. Bear	
29. Here spoon	Location + X
30. Yee	
31. Come on	
32. Come on	
33. Pop	
34. Popcorn	
35. Pop	
36. Hello baby	Introducer + X
37. Found it	Action + Object
38. Mickey	
39. Oh, oh	
40. Hand	
41. Baby	
42. Baby	
43. More powder	Modifier + Head Recurrence
44. See	
45. Right here	
46. Milk	
47. Star	
48. More	

49. More pudding	Modifier + Head Recurrence
50. Two star	Modifier + Head Attribution

SUBJECT 2

Child's Utterances	Semantic-Grammatical Rules
1. Oh, oh	
2. Now, hey	
3. Mo, mamma	Introducer + X
4. Look	
5. Take her bottle	Action + Object: Modifier + Head Possession
6 I turn on	Agent + Action
7. Mold you bottle	Action + Object: Modifier + Head Possession
8. Yes, she drinking	Introducer + X; Agent + Action
9. Bye, bye Leah	Introduction + X
10. Give me that	Action + Object
11. Please	
12. Give me that, please	Action + Object
13. Thank you	
14. Give me a towel, please	Action + Object: Modifier + Head Attribution
15. Night, night	
16. She wanna bottle	Experiencer + State; Agent + Object; Agent + Object
17. Hight, night	
18. Yeah	
19 Hello	
20. Yes, mamma	Introducer + X
21. Bye	

22. I gotta telephone	Agent + Action
23. Bye	
24. Give me baby, please	Action + Object
25. No	
26. She want stove	Experiencer + State, Agent + Object; Action + Object
27. I want that bottle	Agent + Object; Action + Object: Modifier + Head Attribution
28. Thank you	
29. Hold bottle	Action + Object
30. She want bottle	Experiencer + State; Agent + Object: Action + Object
31. Yes	
32. Don't do that	Action + Object; Negation + X
33. Sit up	Action + Location
34. Baby, you gotta go sleep	Introducer + X; Agent + Action
35. You go to sleep	Agent + Action
36. You gotta go to sleep, too	Agent + Action
37. Tell her, all day she go to sleep	Agent + Object
38. She want a bottle	Experiencer + State, Agent + Object; Action + Object
39. She went a bottle	Experiencer + State; Agent + Object, Action + Object
40. No, she need soap	Introducer + X; Experiencer + X; Action + Object
41. Not baby	Negation + X
42. Yes, she need take a bath and go to bed	Introducer + X; Experiencer + State; Agent + Object; Location + Action
43. I want that, please	Experiencer + X; Agent + Object;

	Action + Object
44. Please	
45. I want that, please	Experiencer + X; Agent + Object; Action + Object
46. She gotta take a nap	Experiencer + X; Agent + Object
47. Put your hand	Action + Object; Modifier + Head Possession
48. Go to sleep	
49. You're gotta go to sleep	Agent + Action
50. She gotta go to sleep	Agent + Action

SUBJECT 3

Child's Utterances	Semantic-Grammatical Rules
1. You see my face	Agent + Action; Action + Object; Agent + Object; Modifier + Head Possession
2. I wanna cook	Experiencer + State
3. Cook	
4. I wanna talk to phone	Experiencer + State
5. Put there	Action + Location
6. Move that	Action + Object
7. Move there	Action + Location
8. I wanna talk to	Experiencer + State
9. Hey	
10. I need a bottle	Experiencer + State; Agent + Object; Action + Object
11. I'm gonna call you, OK?	Agent + Action; Agent + Object; Action + Object
12. There's no water, now	Introducer + X; Negation + X
13. Open it	Action + Object
14. Hello	
15. Here you talk	Introducer + X; Agent + Action
16. Move your hair	Action + Object; Modifier + Head Possession
17. Wait, wait	
18. Wait	
19. Talk	
20. No	

21. Phone call	
22. I need a bed	Experiencer + State; Agent + Object; Action + Object
23. I need a bed	Experiencer + State; Agent + Object; Action + Object
24. Move there	Action + Location
25. I wanna telephone	Experiencer + State; Agent + object; Action + Object
26. It's baby, it's baby	Introducer + X
27. Yes, you baby	Introducer + X
28. Put baby bed on 29. See it	Action + Object; Action + Location Agent + Object
30. See	
31. You see it	Agent + Object; Action + Object; Agent + Action
32. No	
33. No, my baby, no	Introducer + X; Modifier + Head Possession
34. Get up	
35. Get on a bed	Action + Location
36. Wait	
37. Now, see her	Introducer + X; Action + Object
38. Open your mouth	Action + Object; Modifier + Head Possession
39. Open, open your mouth	Action + Object; Modifier + Head Possession
40. I wanna XXX your nose	Agent + Object; Action + Object, Agent + Action; Modifier + Head Possession
41. Write your name	Action + Object; Modifier + Head Possession
42. No more	

43. I wanna call	Experiencer + State
44. Please	
45. this	
46. Get the phone	Action + Object
47. I wanna cook	
48. No, I wanna cooking myself	Introducer + X; Experiencer + State
49. Close your eyes	Action + Object; Modifier + Head Possession
50. No, I wanna do it	Introducer + X; Experiencer + State; Action + Object; Agent + Object

SUBJECT 4

Child's Utterances	Semantic-Grammatical Rules
1. Her heirs?	Modifier + Head Possession
2. Where's mouth?	
3. Mouth	
4. Hers noses right here	Modifier + Head Possession; Agent + Location
5. OK	
6. Seer, Mickey mouse	
7. Mickey, here's Donald Duck	Introducer + X; Agent + Location
8. And bear's there	Agent + Location
9. There's a baby	Introducer + X
10. Hello, rabbit	
11. Doctor	
12. I'm a doctor	
13. Yes	
14. For the baby, baby	
15. Where's baby's XXX	Modifier + Head Possession
16. What's this?	
17. Does she went this?	Agent + Object; Experiencer + State, Action + Object
18. Yeah	
19. A doctor	
20. OK	
21. Mickey is not here	Agent + Location; Negation + X
22. Mickey is here	Agent + Location

23. Yeah, diaper	Introducer + X
24. Yes, a diaper	Introducer + X
25. Yes	
26. Diaper?	
27. A doctor's not here	Negation + X; Agent + Location
28. Right here	
29. Hello	
30. Sock	
31. Mommy, put in the bed	Introducer + X; Action + Location
32. Yes	
33. I got put her bed, on her bed	Agent + Object; Action + Object; Agent + Action; Object + Location; Modifier + Head Possession
34. She needs some water?	Experiencer + State; Agent + Object; Action + Object; Modifier + Head Attribution
35. She needs some water	Experiencer + State; Agent + Object; Action + Object, Modifier + Head Attribution
36. Yeah	
37. Open? open	
38. OK	
39. I got put the diaper	Agent + Object; Action + Object; Agent + Action
40. Hello	
41 Yes	
42. Right here	
43. How are you?	
44 I got put her in the	Agent + Object; Action + Object; Agent + Action; Action + Location

45. Yeah	
46. Yes	
47. Our Mickey is there	Modifier + Head Possession; Agent + Location
48. I got here	Agent + Action; Action + Location
49. Mickey mouse	
50 OK	

APPENDIX B
VERBAL STIMULI

Script 3 (Milkshake-making) on Agent-Action-Object

Generalization Items

Subject, Object	Original Sentences	Subject, Object	Reversed Sentences
+, +	1. Make Bunny wash the bear.	+, +	1. Make the bear wash Bunny.
+, -	2. Make Bunny kiss the cup.	-, +	2. Make the cup kiss Bunny.
-, +	3. Make the block shake the bear.	+, -	3. Make the bear shake the block.
-, -	4. Make the block smell the milkshake.	-, -	4. Make the milkshake smell the block.

Training Items

Subject, Object	Original Sentences	Subject, Object	Reversed Sentences
+, +	1. Make Mickey wash the baby.	+, +	1. Make baby wash Mickey.
+, -	2. Make Mickey kiss the cup.	-, +	2. Make the cup kiss Mickey.
-, +	3. Make the bottle shake the baby.	+, -	3. Make the baby shake the bottle.
-, -	4. Make the spoon smell the milkshake	-, -	4. Make the milkshake smell the spoon.

Script 2 (Pudding-making) on Agent-Action-Object

Generalization Items

Subject, Object	Original Sentences	Subject, Object	Reversed Sentences
+, +	1. Make Bunny wash the bear.	+, +	1. Make the bear wash Bunny.
+, -	2. Make Bunny kiss the cup.	-, +	2. Make the cup kiss Bunny.
-, +	3. Make the block shake the bear.	+, -	3. Make the bear shake the block.
-, -	4. Make the block smell the pudding.	-, -	4. Make the pudding smell the block.

Trainning Items

Subject, Object	Original Sentences	Subject, Object	Reversed Sentences
+, +	1. Make Mickey wash the baby.	+, +	1. Make Mickey wash the baby.
+, -	2. Make Mickey kiss the cup.	-, +	2. Make the cup kiss Mickey.
-, +	3. Make the bottle shake the baby.	+, -	3. Make the baby shake the bottle.
-, -	4. Make the spoon smell the pudding.	-, -	4. Make the pudding smell the spoon.

Script 3 (Milkshake-making) on Agent-Action-Object

Generalization Items

Subject, Object	Original Sentences	Subject, Object	Reversed Sentences
+, +	1. Make Bunny wash the bear.	+, +	1. Make the bear wash Bunny.
+, -	2. Make Bunny kiss the cup.	-, +	2. Make the cup kiss Bunny.
-, +	3. Make the block shake the bear.	+, -	3. Make the bear shake the block.
-, -	4. Make the block smell the milkshake.	-, -	4. Make the milkshake smell the block.

Training Items

Subject, Object	Original Sentences	Subject, Object	Reversed Sentences
+, +	1. Make Mickey wash the baby.	+, +	1. Make baby wash Mickey.
+, -	2. Make Mickey kiss the cup.	-, +	2. Make the cup kiss Mickey.
-, +	3. Make the bottle shake the baby.	+, -	3. Make the baby shake the bottle.
-, -	4. Make the spoon smell the milkshake.	-, -	4. Make the milkshake smell the spoon.

Nonscript 1 on Agent-Action-Object

Generalization Items

Subject, Object	Original Sentences	Subject, Object	Reversed Sentences
+, +	1. Make Bigbird wash the dog.	+, +	1. Make the dog wash Bigbird.
+, -	2. Make Bigbird kiss the hammer.	-, +	2. Make the hammer kiss Bigbird.
-, +	3. Make the shoe shake the dog.	+, -	3. Make the dog shake the shoe.
-, -	4. Make the stick smell the flower.	-, -	4. Make the flower smell the stick.

Training Items

Subject, Object	Original Sentences	Subject, Object	Reversed Sentences
+, +	1. Make Dasey Duck wash Burt.	+, +	1. Make Burt wash Dasey Duck.
+, -	2. Make Burt kiss the hammer.	-, +	2. Make the hammer kiss Burt.
-, +	3. Make the towel shake Dasey Duck.	+, -	3. Make Dasey Duck shake the towel.
-, -	4. Make the car smell the flower.	-, -	4. Make the flower smell the car.

Nonscript 2 on Agent-Action-Object

Generalization Items

Original Sentences		Reversed Sentences	
Subject, Object		Subject, Object	
+, +	1. Make the dog wash Bigbird.	+, +	1. Make Bigbird wash the dog.
+, -	2. Make the glasses kiss Bigbird	-, +	2. Make Bigbird kiss the glasses.
-, +	3. Make the shoe shake the dog.	+, -	3. Make the dog shake the shoe
-, -	4. Make the soap smell the stick.	-, -	4. Make the stick smell the soap.

Training Items

Original Sentences		Reversed Sentences	
Subject, Object		Subject, Object	
+, +	1. Make Dassy wash Burt.	+, +	1. Make Burt wash Dassy Duck.
+, -	2. Make Burt kiss the glasses.	-, +	2. Make the glasses kiss Burt.
-, +	3. Make the bag shake Dassy Duck.	+, -	3. Make Dassy Duck shake the bag.
-, -	4. Make the car smell the soap.	-, -	4. Make the soap smell the car.

Noncript 3 on Agent-Action-Object

Generalization Items

Subject, Test	Original Sentences	Subject, Test	Reversed Sentences
+, +	1. Make the wash Bigbird.	+, +	1. Make Bigbird wash the dog.
+, −	2. Make Bigbird kiss the boat.	−, +	2. Make the boat kiss Bigbird.
−, +	3. Make the dog shake the shoe.	+, −	3. Make the shoe shake the dog.
−, −	4. Make the stick smell the flower.	−, −	4. Make the flower smell the stick.

Training Items

Subject, Test	Original Sentences	Subject, Test	Reversed Sentences
+, +	1. Make Dasey Duck wash Burt.	+, +	1. Make Burt wash Dasey Duck.
+, −	2. Make Burt kiss the boat.	−, +	2. Make the boat kiss Burt.
−, +	3. Make Dasey Duck shake the hat.	+, −	3. Make the hat shake Dasey Duck.
−, −	4. Make the car smell the flower.	−, −	4. Make the flower smell the car.

APPENDIX C
EXAMPLE OF THE RESEARCHER'S ROUTINE PHRASES

Popcorn-making Script Probe for the Agent-Action-Object Construction (Cycle 1)

Nonscorable Items	Target Items
1. Put the popcorn into the popcorn-maker	1. Make the cup smell the popcorn. 2. Make the popcorn smell the cup.
2. Put the butter.	
3. Eat the popcorn.	
4. Feed the baby.	3. Make Mickey wash the baby. 4. Make the baby wash Mickey.
5. Open the box.	5. Make the baby shake the bottle.
6. Get the juice bottle.	6. Make the bottle shake the baby. 7. Make Mickey kiss the cup. 8. Make the cup kiss Mickey.

Nonscript 1 Probe for the Agent-Action-Object Construction (Cycle 1)

Nonscorable Items	Target Items
1. Give me dog.	
2. Give me Bigbird.	1. Make the dog wash Bigbird. 2. Make Bigbird wash the dog.
3. Give me hammer.	3. Make Bigbird kiss the hammer. 4. Make the hammer kiss Bigbird.
4. Give me shoe.	5. Make the dog shake the shoe. 6. Make the shoe shake the dog.
5. Give me stick.	
6. Give me flower.	7. Make the stick smell the flower. 8. Make the flower smell the stick.

Popcorn-making Script Training for the Agent-Action-Object Construction (Cycle 2)

Nonscorable Utterances	Target Items
1. The popcorn smells good.	1. Make the cup smell the popcorn. 2. Make the popcorn smell the cup.
2. The baby is dirty.	3. Make Mickey wash the baby.
3. Mickey is dirty.	4. Make the baby wash Mickey. 5. Make the baby shake the bottle
4. The baby needs sleep.	6. Make the bottle shake the baby.
5. Mickey loves the cup.	7. Make Mickey kiss the cup.
6. Let's make the cup return the kiss.	8. Make the cup kiss Mickey.

Nonscript 1 Training for the Agent-Action-Object Construction (Cycle 2)

Nonscorable Utterances	Target Items
1. Give me Dosey Duck.	
2. Give me Burt.	1. Make Dosey Duck wash Burt. 2. Make Burt wash Dasey Duck.
3. Give me hammer.	3. Make Burt kiss the hammer. 4. Make the hammer kiss Burt.
4. Give me towel.	5. Make Dosey Duck shake the towel. 6. Make the towel shake Dosey Duck.
5. Give me car.	
6. Give me flower.	7. Make the car smell the flower. 8. Make the flower smell the car.

APPENDIX D
DESIGN FOR TWO TREATMENTS ADMINISTSRED WITH FOUR SUBJECTS
AT TWO DIFFERENT PSRIODS

Subject	TR[a]	Baseline	Treatments	Maintenance	Total
		Sessions			
		1 2 3 4 5 6 7	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20	1 2 3	
S1	S[b]	AMAMPMAM	PMPMPMPMAMAMAMAMPMAMPMAMAMAMPM	AMAMAM	AM:14
	NS[c]	PMAMPMAM	AMAMAMPMPMPMAMPMAMAMPMPMAMPMAM	AMAMAM	AM:13
S2	S	AMPMAMAMAM	PMAMPMPMAMAMAMAMAMPMAMAMAMAMPMAMPMPMAM	AMAMAM	AM:16
	MS	PMAMPMAMAM	AMAMAMPMAMAMAMPMPMPMPMPMAMPMAMAMAMPMAMAM	AMAMAM	AM:18
S3	S	AMPMPMAMPMAM	PMPMPMAMAMAMPMAMAMAMAMPMAMPM	AMAMAM	AM:14
	NS	PMAMPMAMAMAM	PMAMPMAMPMAMAMAMPMAMAMAMAMAM	AMAMAM	AM:17
S4	S	AMPMAMAMPMAMAMAMPMAMAMAMPMPMAMAMAMAMPMAMPMAMPMPM		AMAMAM	AM:19
	NS	PMAMAMPMAMPMAMPMAMPMPMAMAMAMPMPMAMPMAMAMPMPMAMAM		AMAMAM	AM:18

[a]Treatment
[b]Script
[c]Nonscript

APPENDIX E
EXAMPLES OF SCORING SHEETS FOR POPCORN-MAKING SCRIPT AND NONSCIPRT 1

Score Sheet for Popcorn-making Training Items
for Agent-Action-Object

Subject: _____
Date & Time: _____

_____ 1. Make the cup smell the popcorn.
Child: _____
Strategy: _____
Training: a) only verbal stimulus ___ ( )
b) after demonstration ___ ( )
c) after physical prompt ___ ( )
d) fail ___

_____ 2. Make the popcorn smell the cup.
Child: _____
Strategy: _____
Training: a) only verbal stimulus ___ ( )
b) after demonstration ___ ( )
c) after physical prompt ___ ( )
d) fail ___

_____ 3. Make Micky wash the baby.
Child: _____
Strategy: _____
Training: a) only verbal stimulus ___ ( )
b) after demonstration ___ ( )
c) after physical prompt ___ ( )
d) fail ___

_____ 4. Make the baby wash Micky.
Child: _____
Strategy: _____
Training: a) only verbal stimulus ___ ( )
b) after demonstration ___ ( )
c) after physical prompt ___ ( )
d) fail ___

_____ 5. Make the baby shake the bottle.
Child: _____
Strategy: _____
Training: a) only verbal stimulus ___ ( )
b) after demonstration ___ ( )
c) after physical prompt ___ ( )
d) fail ___

_____ 6. Make the bottle shake the baby.
Child: _____
Strategy: _____
Training: a) only verbal stimulus ___ ( )
b) after demonstration ___ ( )
c) after physical prompt ___ ( )
d) fail ___

_____ 7. Make Micky kiss the cup.
Child: _____
Strategy: _____
Training: a) only verbal stimulus ___ ( )
b) after demonstration ___ ( )
c) after physical prompt ___ ( )
d) fail ___

_____ 8. Make the cup kiss Micky.
Child: _____
Strategy: _____
Training: a) only verbal stimulus ___ ( )
b) after demonstration ___ ( )
c) after physical prompt ___ ( )
d) fail ___

Comment:

Score Sheet for Nonscript 1 Training Items
for Agent-Action-Object"

Subject: _____
Date & Time: _____

_____ 1. Make Dassy Duck wash Burt.
Child: _____
Strategy: _____
Training: a) only verbal stimulus ___ ( )
b) after demonstration ___ ( )
c) after physical prompt ___ ( )
d) fail ___

_____ 2. Make Burt wash Dassy Duck.
Child: _____
Strategy: _____
Training: a) only verbal stimulus ___ ( )
b) after demonstration ___ ( )
c) after physical prompt ___ ( )
d) fail ___

_____ 3. Make Burt kiss the hammer.
Child: _____
Strategy:
Training: a) only verbal stimulus ___ ( )
b) after demonstration ___ ( )
c) after physical prompt ___ ( )
d) fail ___

_____ 4. Make the hammer kiss Burt.
Child: _____
Strategy: _____
Training. a) only verbal stimulus ___ ( )
b) after demonstration ___ ( )
c) after physical prompt ___ ( )
d) fail ___

_____ 5. Make Dassy Duck shake the towel.
Child: _____
Strategy: _____
Training. a) only verbal stimulus ___ ( )
b) after demonstration ___ ( )
c) after physical prompt ___ ( )
d) fail ___

____ 6. Make the towel shake Daisy Duck.
Child: _____
Strategy: _____
Training: a) only verbal stimulus ___ ( )
b) after demonstration ___ ( )
c) after physical prompt ___ ( )
d) fail ___

____ 7. Make the car smell the flower.
Child: _____
Strategy: _____
Training: a) only verbal stimulus ___ ( )
b) after demonstration ___ ( )
c) after physical prompt ___ ( )
d) fail ___

____ 8. Make the flower smell the car.
Child: _____
Strategy: _____
Training: a) only verbal stimulus ___ ( )
b) after demonstration ___ ( )
c) after physical prompt ___ ( )
d) fail ___

Comment:

APPENDIX F
MATERIALS FOR EACH CONTEXT

Materials for Script Context (Agent-Action-Object)

Routines	Probe Items	Animate Objects	Inanimate Objects	Equipment
Popcorn-making	Training	Mickey-doll baby-doll	cup, juice, bowl bottle, box, napkin popcorn, butter	popcorn-maker
	Generalization	Bunny-doll bear-doll	cup, juice, bowl bottle, box, popcorn, butter block, napkin	popcorn-maker
Pudding-making	Training	Mickey-doll	cups, spoon, juice bottle, box, napkin pudding powder	mixer
	Generalization	Bunny-doll bear-doll	cups, spoon, juice bottle, box, milk, pudding powder, block, napkin	mixer
Milkshake-making	Training	Mickey-doll	cups, spoon, juice bottle, box, milk, ice cream, napkin	mixer
	Generalization	Bunny-doll bear-doll	cups, spoon, juice bottle, box, milk, ice cream, block, napkin	mixer

Materials for Script Context (Action-Object-Locative)

Routines	Probe Items	Animate Objects	Inanimate Objects	Equipment
Popcorn-making	Training	Mickey-doll baby-doll	cup, juice, bowl bottle, box, popcorn, butter knife, plate, napkin	popcorn-maker
	Generalization	Bunny-doll bear-doll	cup, juice, bowl bottle, box, popcorn, butter shovel	popcorn-maker
Pudding-making	Training	Mickey-doll	cups, spoon, juice bottle, box, pudding powder, bag, fork, napkin	mixer
	Generalization	Bunny-doll bear-doll	cups, spoon, juice bottle, box, milk, pudding powder, napkin bag, knife, towel	mixer
Milkshake-making	Training	Mickey-doll	cups, spoon, juice bottle, box, milk, ice cream, fork, napkin	mixer
	Generalization	Bunny-doll bear-doll	cups, spoon, juice bottle, box, milk, ice cream, bag, knife, towel, napkin	mixer

Materials for Nonscript Context (Agent-Action-Object)

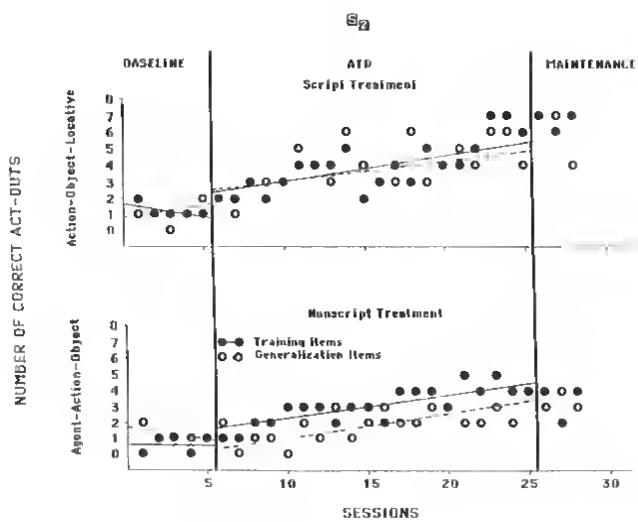
Nonscript Context	Probe Items	Animate Objects	Inanimate Objects
Nonscript 1	Training	Daisy Duck-doll Burt-doll	hammer, towel, car, flower
	Generalization	Bigbird-doll dog-doll	hammer, shoe, stick, flower
Nonscript 2	Training	Daisy Duck-doll Burt-doll	glasses, bag, car, soap
	Generalization	Bigbird-doll dog-doll	glasses, shoe, stick, soap
Nonscript 3	Training	Daisy Duck-doll Burt-doll	boat, hat, car, flower
	Generalization	Bigbird-doll dog-doll	boat, shoe, stick, flower

Materials for Nonscript Context (Action-Object-Locative)

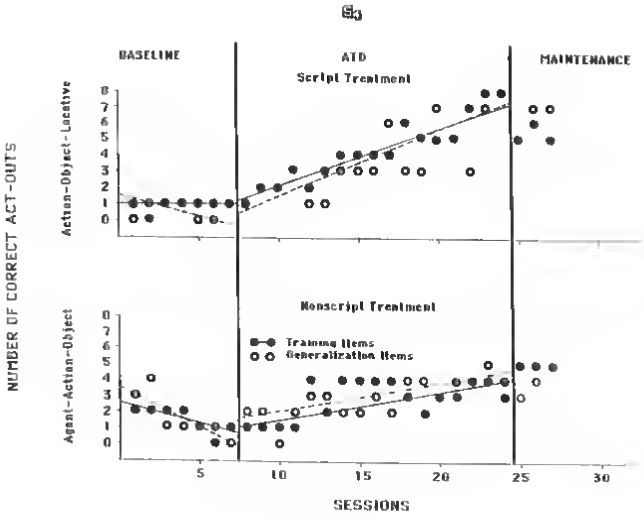
Nonscript Context	Probe Items	Animate Objects	Inanimate Objects
Nonscript 1	Training	Daisy Duck-doll Burt-doll	bed, car, sock, truck, ball, hammer
	Generalization	Bigbird-doll dog-doll	bed, sock, truck, ball towel, couch
Nonscript 2	Training	Daisy Duck-doll Burt-doll	bed, car, sock, truck, hat, glasses
	Generalization	Bigbird-doll dog-doll	bed, sock, truck, glasses, towel, couch
Nonscript 3	Training	Daisy Duck-doll Burt-doll	boat, car, sock, truck, couch, ball
	Generalization	Bigbird-doll dog-doll	bed, sock, truck, ball, towel, hat

APPENDIX G
TREND LINES ACROSS SCRIPT AND NONSCRIPT CONDITIONS FOR TREATMENT AND GENERALIZATION DATA FOR EACH SUBJECT

BASELINE
AID
Script Treatment
MAINTENANCE
Nonscript Treatment
Training Items
Generalization Items
Agent-Action-Object
Action-Object-Location
NUMBER OF CORRECT ACT-OUTS
SESSIONS

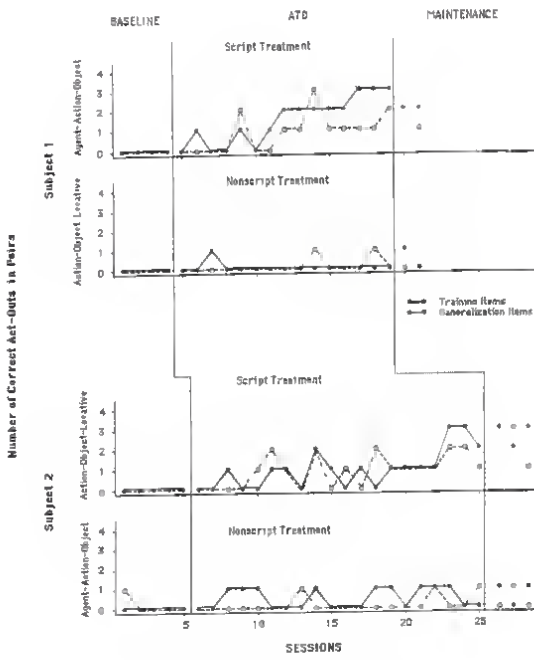

S2
BASELINE
ATP
MAINTENANCE
Script Treatment
Action-Object-Locative
Nonscript Treatment
Agent-Action-Object
Training Items
Generalization Items
NUMBER OF CORRECT ACT-OUTS
SESSIONS

S3
BASELINE
ATD
Script Treatment
MAINTENANCE
Agent-Action-Object
Action-Object-Locative
Nonscript Treatment
Training Items
Generalization Items
0
1
2
3
4
5
6
7
8
5
10
15
20
25
30
SESSIONS
NUMBER OF CORRECT ACT-OUTS


S3
BASELINE
ATD
MAINTENANCE
Script Treatment
Action-Object-Locative
Nonscript Treatment
Agent-Action-Object
Training Items
Generalization Items
NUMBER OF CORRECT ACT-OUTS
SESSIONS

APPENDIX H

NUMBER OF CORRECT-ACT OUTS FOR ALL SUBJECTS ACROSS TWO TREATMENT CONDITIONS FOR TREATMENT AND GENERALIZATION DATA USING A PAIRED-SCORING SYSTEM


BASELINE
ATD
MAINTENANCE
Subject 1
Subject 2
Script Treatment
Nonscript Treatment
Agent-Action-Object
Action-Object-Locative
Training Items
Generalization Items
Number of Correct Act-Outs in Pairs
SESSIONS
5
10
15
20
25

BASELINE
ATD
MAINTENANCE
Subject 3
Agent-Action-Object
Script Treatment
Action-Object-Locative
Nonscript Treatment
Training Items
Generalization Items
Subject 4
Action-Object-Locative
Script Treatment
Agent-Action-Object
Nonscript Treatment
Number of Correct Act-Outs in Pairs
SESSIONS

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BIOGRAPHICAL SKETCH

Young Tae Kim was born on June 15, 1959, in Seoul, Korea. She graduated from the Sun Kyun Kwan University in February, 1982, with a Bachelor of Arts degree in home economics. She came to the U.S.A. in 1983 and attended the Appalachian State University for a year, where she completed undergraduate courses in speech pathology. After she earned a Master of Arts degree at the University of Florida, she entered the doctoral program of the Speech Department at the U.F. in 1986, majoring in speech pathology. She will be awarded her Doctor of Philosophy degree in December 1989 with specialization in speech pathology.

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

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Associate Professor of Speech

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

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This dissertation was submitted to the Graduate Faculty of the Department of Speech in the College of Liberal Arts and Sciences and to the Graduate School and was accepted as partial fulfillment of the requirements for the degree of Doctor of Philosophy.

December, 1989

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